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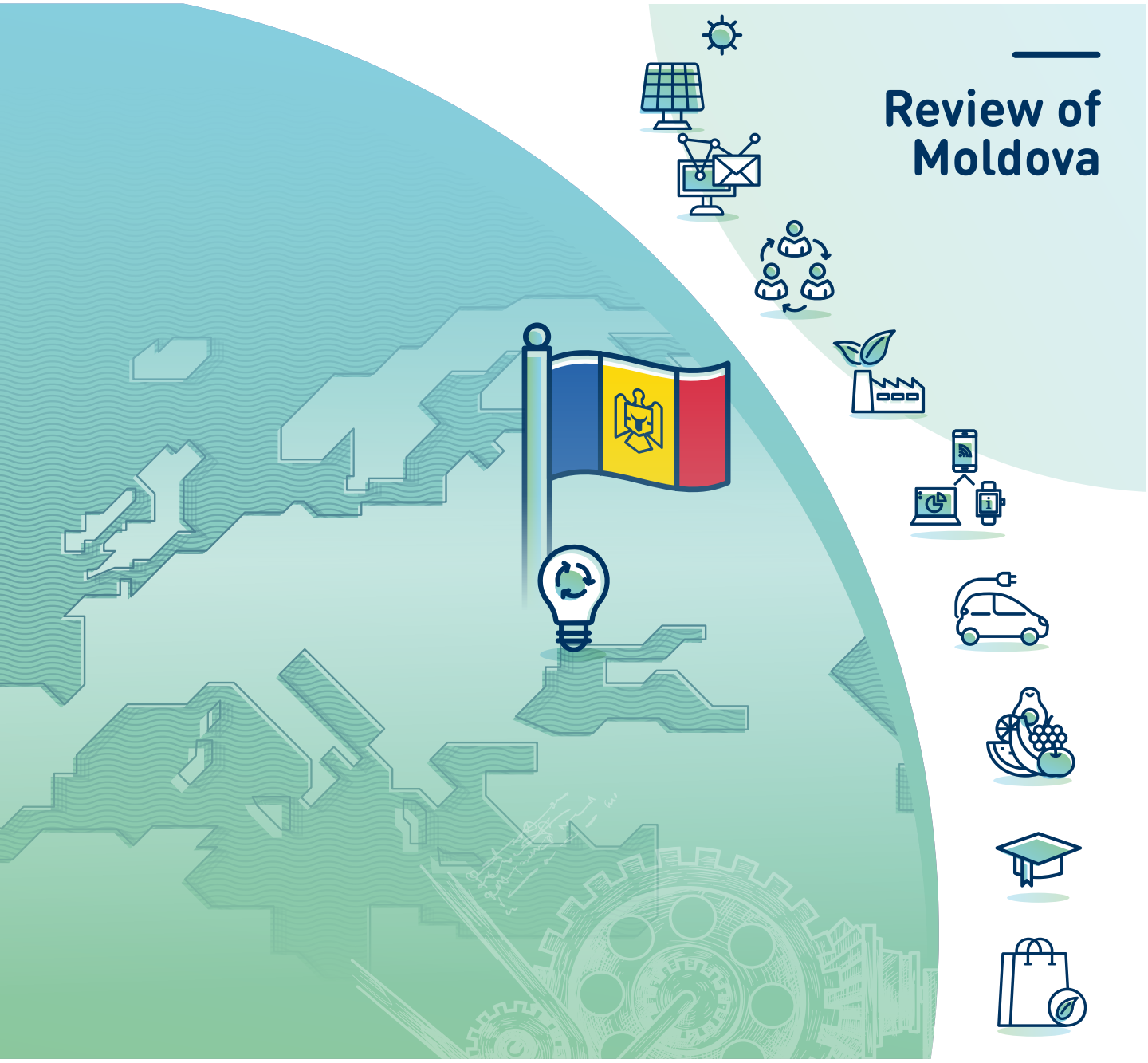
Innovation for Sustainable Development

Review of Moldova



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Innovation for Sustainable Development

Review of Moldova

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FOREWORD

Since independence, Moldova has navigated the challenging transition to a market economy while achieving significant, albeit volatile, economic growth, reduced poverty levels and the status of a lower-middle-income economy. However, productivity growth has declined as original drivers of structural change in the early post-independence era have run out of steam. Moldova's commitments under the United Nations 2030 Agenda for Sustainable Development and the imperative to transition towards a more circular and inclusive economy, will mean that innovation, in the form of systematic experimentation with ideas, must take centre stage in development efforts. Recent events have made such an approach even more important to ensure a resilient post-pandemic recovery.

Over the past decade, Moldova has made significant efforts to improve its business environment and encourage innovation through regulatory reform, providing better conditions for entrepreneurs and enhancing its national innovation system. Successful examples of innovative development taking root in Moldova can be found in the IT sector, Free Economic Zones, certain knowledge and technology-based firms in traditional industries as well as in the agri-food supply chain, all of which can be viewed as "pockets of excellence".

While commendable, current developments cannot fully address key future social, economic and environmental challenges until such experimentation is sufficiently widespread and embedded in the Moldovan economy. A clear, targeted focus on improving private sector capabilities, as well as those of public and private research organizations, to absorb and adapt ideas will be crucial, especially in the aftermath of the COVID-19 pandemic. Scaling up initiatives that work, drawing on the substantial potential of a highly-educated workforce and harnessing the diaspora's social capital will all require well-coordinated policy action at both the national and subnational levels. Effectively leveraging these key resources, alongside the nation's solid legacy in public research and its proximity to key European and Eurasian markets, could open the door to significant, innovation-driven sustainable development.

This review takes an in-depth look at the factors, both positive and negative, that have a bearing on innovation-led sustainable development in Moldova and provides tailored recommendations to tap the potential for resilient and inclusive social and economic transformation.

UNECE advisory work in the field of innovation draws on longstanding engagement across the countries of Eastern Europe and the South Caucasus, including the recently published Subregional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus. This review also builds on the policy best practices developed by the UNECE Committee on Innovation, Competitiveness and Public-Private Partnerships and is the result of a concerted, comprehensive approach with systematic stakeholder engagement and peer review.

Olga Algayerova

Executive Secretary
United Nations Economic Commission for Europe

PREFACE

Research, analysis and advice on innovation and competitiveness policies is part of UNECE work on economic cooperation and integration that aims to harness innovation as a driver of sustainable development. National reviews of innovation policy, carried out at the request of Member States, have developed significantly since their inception more than a decade ago. Today, they follow a recently updated methodology and approach that has resulted in Innovation for Sustainable Development Reviews. This new approach addresses national priorities under the United Nations 2030 Agenda for Sustainable Development.

The research for the Innovation for Sustainable Development Review (I4SDR) of Moldova began in January 2020 with consultations to agree upon the scope of the I4SDR with the national authorities and other stakeholders during the research phase of the UNECE Sub-regional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus. This was followed by a fact-finding mission that was conducted online from February to April 2021 due to the COVID-19 pandemic. National priorities for sustainable development were selected for in-depth consideration in three elective chapters covering: science-industry linkages and technology commercialization; innovation and technology transfer infrastructure; and leveraging the diaspora for innovation-driven sustainable development.

While this is the first I4SDR conducted for Moldova, it builds on and complements the findings of the Sub-regional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus. This review provides detailed policy recommendations on innovation policy governance to strengthen the national innovation system and reflects the national specificities and sustainable development priorities of Moldova.

The I4SDR is the result of in-depth dialogue and consultation among the UNECE Secretariat, leading experts on the subject matter, Government officials, academia, private sector actors and other innovation stakeholders in Moldova. During August and September 2021, the draft text underwent peer review by national stakeholders and international experts before the findings and recommendations were endorsed by national stakeholders on 16 December 2021 during a virtual roundtable.

The final text of the review was prepared for publication by the UNECE Secretariat and reflects the outcome of the above-mentioned consultations, as well as feedback received from key stakeholders.

ACKNOWLEDGEMENTS

The UNECE Innovation for Sustainable Development Review of Moldova was developed under the auspices of the Committee on Innovation, Competitiveness and Public-Private Partnerships with financial support from the Government of Sweden. UNECE expresses its gratitude to the national focal point partners: Ms. Aliona Onofrei and Ms. Olga Tretiacov, the Research and Innovation Policy Directorate at the Ministry of Education and Research of the Republic of Moldova (MER). Their dedication and support have been instrumental in the successful implementation of this review.

The publication was drafted under the leadership of Ms. Elisabeth Tuerk, Director of the UNECE Economic Cooperation and Trade Division, and under the overall supervision and guidance of Mr. Anders Jönsson, Chief of the UNECE Innovative Policies Development Section. Mr. Christopher Athey, UNECE Economic Affairs Officer, led the implementation of the review, including the fact-finding and peer review of policy recommendations. The authors of the chapters were Mr. Anders Jönsson and Ms. Tatiana Rosu (Chapter 1); Ms. Lyudmyla Tautiyeva and Mr. Anders Jönsson (Executive Summary, Chapter 2, Chapter 3); Mr. Slavo Radosevic (Chapter 4); Ms. Lisa Cowey (Chapter 5); and Mr. Aleksandr Gevorkyan (Chapter 6). Ms. Lyudmyla Tautiyeva provided valuable coordination support throughout the project. Mr. Sergiu Porcescu and Ms. Diana Russu, both national consultants, carried out essential background research and facilitated the fact-finding process. Ms. Ludmila Boichuk provided technical and administrative assistance throughout the project while Mr. Ian Silver edited the text and Mr. Thierry Alran developed the design and layout of the publication.

The continuous engagement of the MER, the lead national partner for this review, was essential throughout this process. Valuable inputs were provided at the fact-finding stage by national stakeholders from the public sector, including the Ministry of the Economy (MoE), the Ministry of Infrastructure and Regional Development (MIRD), the National Agency for Research and Development (NARD), the State Chancellery, the National Agency for Quality Assurance in Education and Research, the National Bureau of Statistics, the State Agency on Intellectual Property, the E-Government Agency, the Office of the President of Moldova, the Organization for Development of Small and Medium-sized Enterprises (ODIMM), the Institute of Power Engineering, and the Institute of Genetics, Physiology and Plant Protection. Valuable insights were also provided by private sector stakeholders, particularly the Chamber of Commerce and Industry (CCI), the Republican Businessmen Club «Time», the Moldovan Association of ICT Companies (ATIC), the Free Economic Zone Balti, the Tekwill project team, the Soroca Business Incubator, innovation incubator staff at InnoCenter, innovation incubator staff at the State University of Moldova, the "Berries of Moldova" association and the companies «TOPAZ», "ELIRI" and CodeFactory. Finally, international partners with a local presence in Moldova, in particular, the Delegation of the European Union, the Mission of International Organization for Migration (IOM) and the United States Agency for International Development (USAID) Moldova Competitiveness Project team made valuable contributions to this review. The United Nations Resident Coordinator's Office and the United Nations Development Programme (UNDP) in Moldova also provided useful support throughout the review process.

In addition to the UNECE's internal deliberations, several other organizations reviewed and commented on the review's findings and recommendations, including the Diaspora Relations Bureau of Moldova (DRB), the Economic Council to the Prime Minister of Moldova, the European Commission's Joint Research Centre (JRC), the Food and Agriculture Organization (FAO) of the United Nations in the Republic of Moldova, the Organization for Economic Co-operation and Development (OECD), the Embassy of Sweden in Moldova and the Swedish International Development Cooperation Agency Representation in Moldova.

UNECE would like to express its deep gratitude to the Swedish International Development Cooperation Agency (Sida) for its generous financial support to this project.

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ABBREVIATIONS

AGEPI	State Agency for Intellectual Property
ATIC	National Association of ICT Companies
BoP	Balance of Payments
CCI	Chamber of Commerce and Industry
CE	Circular Economy
CEE	Central and Eastern European
CIS	Commonwealth of Independent States
COVID	Coronavirus Disease
CPI	Consumer Price Index
DARE	Diaspora Succeeds at Home
DCFTA	Deep and Comprehensive Free Trade Agreement
DRB	Diaspora Relations Bureau
DSG	Diaspora Science Group
EBRD BEEPS	European Bank for Reconstruction and Development's Business Environment and Enterprise Performance Survey
EESC	European Economic and Social Committee
EGDI	e-Government Development Index
EIB	European Investment Bank
ENQA	European Network for Quality Assurance
ERA	European Research Area
EU	European Union
FabLab	Fabrication Laboratory
FAST	Foundation for Armenian Science and Technology
FDI	Foreign Direct Investment
FEZ	Free Economic Zone
FSU	Former Soviet Union
FTA	Free Trade Agreement
GDFP	Greek Diaspora Fellowship Program
GDP	Gross Domestic Product
GEF	Global Environment Facility
GERD	Gross Domestic Expenditure on Research and Development
GII	Global Innovation Index
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit Gmbh
GVC	Global Value Chain
HEI	Higher-Education Institutions
HTA	Hometown Association
ICT	Information and Communication Technologies
IEP	Innovation Enhancing Procurement
IHGEs	innovative high-growth enterprises
ILO	International Labour Organization
INTERREG	Danube Transnational Programme
IOM	International Organization for Migration
IP	Intellectual Property
IPR	Intellectual Property Rights
ISO	International Standards Organization
IT	Information Technology
ITTC	Innovation and Technology Transfer Centres
KPI	Key Performance Indicators

KT	Knowledge Transfer
MAFI	Ministry of Agriculture and Food Industry
MDL	Moldovan Leu
MEETAfrica	European Mobilisation for Entrepreneurship in Africa
MER	Ministry of Education and Research
MiDL	Migration and Local Development
MIRD	Ministry of Infrastructure and Regional Development
MoE	Ministry of Economy
MoF	Ministry of Finance
MoU	Memorandum of Understanding
MSc	Master of Science
NARD	National Agency on Research and Development
NGO	Non-Government Organization
NIC	National Innovation Council
NIST	National Institute of Standards and Technology
NPRI	National Programme on Research and Innovation
ODIMM	Organization for Small and Medium-sized Enterprise Development
PARE	Program on Attracting Remittances into the Economy
PhD	Doctor of Philosophy
PRO	Public Research Organizations
R&D	Research and Development
R&D&I	Research and Development and Innovation
R&I	Research and Innovation
RIAM	Network of Business Incubators
RTD	Research and Technological Development
S&T	Science and Technology
SDGs	Sustainable Development Goals
SILs	Science-Industry Linkages
SME	Small and Medium-sized Enterprise
SOE	State-Owned Enterprise
SS3	Smart specialization
STEM	Science, Technology, Engineering and Math
STP	Science and Technology Parks
SWOT	Strengths, Weaknesses, Opportunities and Threats
TAIEX	Technical Assistance and Information Exchange
TFP	Total Factor Productivity
TOKTEN	Transfer of Knowledge through Expatriate Nationals
TT	Technology Transfer
TTO	Technology Transfer Office
TUM	Technical University of Moldova
UKF	Unity through Knowledge Fund
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
USARB	Alecu Russo State University of Balti
USD	United States Dollars
VNR	Voluntary National Review
WEEE	Waste from Electrical and Electronic Equipment
WEF	World Economic Forum
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

EXECUTIVE SUMMARY

Central messages of Chapters 3-6

Enhancing the national innovation system and its governance

- The Government has expressed a clear political commitment to supporting innovation, which is reflected by its efforts to establish various innovation support mechanisms. However, experience elsewhere has demonstrated the need for a holistic approach to build an effective national innovation system, something that remains nascent and in need of nurturing in Moldova.
- Currently, innovation governance in Moldova is complex, fragmented across a number of ministries and agencies that lack systematic synergies and institutional capacities to effectively design, implement and monitor innovation-related policies across government.
- Innovation policy requires a more strategic cross-government coordination mechanism to guide and align innovation policy efforts towards effective innovation promotion and support at both the national and sub-national levels.
- Public-private dialogue to ensure inclusive and relevant policies is not yet systematically employed and could be strengthened. This would allow existing mechanisms of stakeholder engagement to be improved and made more productive.
- Innovation in the public sector has seen progress in terms of the digitalization of government services and processes. However, there is substantial scope for further e-Government reform and to use public procurement to drive demand for innovation.

Boosting SILs and commercializing new technology

- The traditional SIL perspective of direct knowledge transfer from research and development (R&D) organizations to the private sector does not capture all aspects of science-industry collaboration in Moldova, where such transfers are often driven by the private sector's need to solve a particular problem.
- In Moldova, three major sources of knowledge and technology seem to drive SILs, forming a 'triple helix' model. They include foreign firms and investors (FDI), domestic firms and public research organizations (PROs) in the national R&D system.
- The capabilities of R&D organizations and the absorptive capacities of the private sector in Moldova limit the potential to form new SILs and require policy intervention to restructure the R&D sector. This restructuring would ideally seek to enhance the quality of higher-education institutions (HEIs), promote internationalization and incentivize private-sector innovation.
- Joint efforts have created several 'pockets of excellence' in information technology (IT), the Free Economic Zones (FEZs), certain knowledge-based and high-tech firms as well as in the agri-food supply chain. These efforts should continue to enjoy Government support as they have significant potential to enhance SILs for both upscaling and knowledge transfers.

Developing innovation and TT infrastructure in Moldova

- Moldova's innovation and TT infrastructure, both physical and virtual, is relatively new and encouragingly diverse in its function and form. Currently, this includes various types of support mechanisms from industrial parks to fabrication laboratories (Fablabs). However, linkages between these diverse components need substantial improvement to ensure they work together efficiently.
- Traditional TT infrastructure is still under-developed in Moldova and most technology transfer offices (TTOs) do not yet fulfil their given roles. An observable key source of this issue is an overall lack of skilled personnel to engage in knowledge transfer (KT) tasks.
- Effective TT requires enhanced linkages between TT infrastructure components, removing bottlenecks in TT legislation, facilitating the creation of viable innovation hubs at the sub-national level and establishing TTOs able to provide feasible pipelines for TT projects.
- Innovation activities are currently concentrated in and around the capital. This has created a need to develop adequate and locally relevant regional infrastructure to close the rural-urban gap in innovation and address regional socio-economic challenges.

Leveraging the diaspora for innovation-driven sustainable development

- The Moldovan diaspora holds much potential for innovative development, however, there is a lack of data to build a nuanced understanding of the location and composition of the diaspora.
- There are many skilled Moldovans permanently residing abroad, often employed in science, technology, engineering and mathematics (STEM) as well as medicine and other knowledge-intensive occupations. These individuals are often eager to contribute to development efforts in their homeland but have difficulty in doing so. Developing and maintaining a flexible mechanism for high-skilled diaspora engagement could greatly benefit KT to Moldova.
- Moldova has implemented a relatively successful and diverse policy approach towards diaspora engagement, however, diaspora engagement programmes often face sustainability issues. Addressing this will require a strategic policy approach with backing from international donor organizations alongside private-sector and diaspora participation.
- Enhancing linkages with the diaspora to facilitate KT (e.g., through the Diaspora Science Group (DSG)) and building trust through systematic and meaningful engagement of the diaspora in policy development will be important to more fully harness the diaspora's potential.

Source: The UNECE.

Structural factors keep innovation from driving in-depth economic transformation and sustainable development

Since its independence, Moldova has navigated a challenging transition to a market economy while achieving significant, albeit volatile, economic growth, reduced poverty levels and the status of a lower-middle-income economy**.** Economic growth is now trending downward as its initial drivers, such as the reallocation of resources and capital to labour-intensive sectors based on cost advantages, existing productive capacities and market-seeking investment, have run out of steam**.**

Improving productivity and competitiveness in Moldova will require shifting factors of production from less productive to more productive activities, both within and among sectors. This, in turn, requires innovation, or the systematic exploration of ideas to see what works and what does not. Improving the overall business environment and, in particular, encouraging high-risk, innovative entrepreneurship should be viewed as paramount. The Government of Moldova has made significant efforts to ensure a better regulatory environment for firms, but continued in-depth reforms are needed to tackle the remaining structural challenges, such as reducing monopoly power, putting in place effective tax mechanisms to support enterprise growth and introducing tools to stimulate private-sector innovation. In addition to these domestic structural problems, the Moldovan economy is vulnerable to external shocks, such as the COVID-19 pandemic, because of an over-reliance on domestic consumption that is driven by government spending and remittances, an issue made worse by demographic decline and emigration.

Targeting and enhancing trade and investment to build productive capacities and transfer knowledge and technology will be essential for innovative development

Trade and FDI are essential to drive economic growth and innovation. Skills, linkages, demand-side incentives and knowledge absorption brought about by trade, value chain integration and foreign investments are leading channels for innovation. However, these are not well-developed in the Moldovan economy. Moldova has untapped potential to diversify and upgrade its exports, with only 3% of total manufactured exports being high-technology exports and, according to World Bank Development indicators, a decline in export complexity from 0.5 in 1990 to -0.3 in 2019. Some domestic companies have successfully integrated into global value chains, however, even these generally exhibit a strong reliance on value-chain partners in their operations. With some recent positive trends in FDI, strategic action is needed to create positive spill-over effects and linkages with the broader economy, support export diversification as well as skills and knowledge transfer. Substantial as yet unrealized potential could be tapped into by leveraging existing trade agreements, such as the Deep and Comprehensive Free Trade Agreement (DCFTA) with the EU and by joining international supply chains to drive technological upgrades.

Building the private sector's capacity to innovate – or firm absorptive capacity – is essential, as is developing human capital with the right skills

Innovation – or broad, systematic experimentation with new ideas to find out what works and what does not, will be central to making the best use of existing potential to

achieve higher productivity, inclusive growth and sustainable development. Much of this potential lies in absorbing and adapting ideas that have proven successful elsewhere. In this regard, enhancing the capacities of domestic firms in Moldova to absorb and adapt these ideas is imperative. Such absorptive capacity in Moldova is quite limited as the private sector R&D expenditure of 0.01% of GDP shows. Data on ISO9000 certificates and trademark applications per million population also highlight the low levels of professionalization of firms compared to comparable economies in Eastern and Central Europe.

Human capital is an essential driver of innovative development and there is a pressing need to align educational curricula with market needs and to enhance the quality of the R&D system in Moldova. Skills mismatch is among the major constraints to doing business in Moldova. Although this can be partially addressed through on-the-job training, substantial efforts are nevertheless needed to enhance education policy, in particular, STEM education. Effective restructuring of the education and R&D system would enhance the skills of graduates, research quality and facilitate the international integration of the Moldovan R&D system (see Chapter 4).

The emigration of high-skilled labour requires policy action to prevent further erosion of this segment of the labour pool. At 24 per cent of the national workforce, Moldova's share of employment in knowledge-intensive sectors is relatively lower than in comparable economies, challenged by the outflows of high-skilled labour. Policies to draw on the human capital of the highly skilled diaspora could help drive innovative and sustainable development throughout Moldova (see Chapter 6).

A productive role for the Government in building the national innovation system requires a holistic perspective supported by strategic multi-level and well-coordinated actions

Despite the clear commitment to support innovation and having already put in place several policies and building blocks of the national innovation system (NIS), the Moldovan ***NIS remains nascent while innovation policy governance is fragmented and lacks strategic direction, coordination and flexibility. Innovation policy is often perceived as a part of research policy. This limits the broader benefits that innovation in the private sector and governance could bring in terms of sustainable development.*** For example, the National Programme for Research and Innovation (2020-2023) (NPRI), the main document guiding innovation policy, focuses on public research and lacks a comprehensive, strategic vision and holistic approach. This focus, while supportive of some aspects of innovation, nevertheless hampers the potentially broad, catalytic effects of government support.

Innovation policy needs a strategic cross-governmental coordination mechanism, such as a National Innovation Council, to guide and align innovation policy efforts. Innovation potential at the sub-national level, although partially addressed by regional smart specialization initiatives, remains largely untapped. Increasing the capacity of local governments to systematically experiment with, facilitate and promote innovation, including by scaling up existing successful initiatives, will be essential for future progress. Such efforts should build on recent decentralization reforms, clustering efforts and pilot programmes run with donor support (e.g. StartUp City Cahul, Tekwill) and include sub-national authorities in national innovation decision-making processes through a body such as a National Innovation Council.

A strategic, transparent and inclusive policy cycle will enhance innovation policy delivery while e-Government and innovation-enhancing public procurement can be used to address demand-side weaknesses

Better governance will require strengthened processes and institutional capacities throughout the policy cycle, in particular, policy dialogue and effective monitoring and evaluation. Public-private dialogue (PPD) and systematic stakeholder consultations are crucial to innovation and should take place regularly and in a transparent manner with the in-depth engagement of all innovation policy actors. Online platforms for public consultations could also be enhanced to ensure broad stakeholder engagement in innovation policy processes. Monitoring and evaluation should be carried out in a more systematic and structured way with the allocation of adequate resources to enhance policy learning for better policy delivery.

Accelerating the e-Government initiative and using public procurement as a strategic tool would help strengthen the demand side of innovation. Following strong initial progress, efforts on e-Government have recently stalled and require renewed political impetus. Measures to accelerate e-Government reforms should be accompanied by the provision of substantial capacity building for civil servants to create a public sector equipped to meet the needs of and support the innovation in a modern private sector. Piloting innovation enhancing procurement could take initial steps towards using the potential of existing and planned public spending to create demand for and stimulate activity in innovation, addressing some of the challenges posed by Moldova's relatively small domestic market and low levels of gross domestic expenditure on research and development (GERD).

Enabling and promoting SILs will mean moving from a traditional linear approach to a demand-driven research policy

Existing SILs are weak in Moldova, with few examples of the systematic use of demand- and opportunity-driven research results. Experience elsewhere has shown that effective policies to support SILs are those that go beyond supporting a linear approach to such cooperation of direct knowledge transfer from R&D organizations to the real sector of the economy. Rather than having SILs built upon the commercialization of public R&D, SILs in Moldova are typically driven by the private sector seeking support from R&D organizations on production or certification issues, with strong sectoral specificities. The absorptive capacities of the private sector and the capabilities of R&D organizations to produce high-quality research results with commercialization potential are crucial elements in this regard.

Currently, innovation activity in the private sector is dominated by the purchase of equipment and machinery (70.5 per cent of overall expenditures related to innovation), with a small share of intramural R&D (23.8 per cent) and marginal demand for extramural R&D (1.1 per cent). This highlights the ***limited absorptive capacities of firms and contributes to their poor linkages with the R&D sector, with only 6 per cent of firms cooperating with universities and research organizations on innovation activities.***

With GERD as low as 0.3 per cent of GDP, ***the R&D sector and HEIs need major reform to enhance the quality of research results and create incentives and capacities to***

effectively meet private sector demands. This could be achieved through a gradual restructuring of PROs to enhance quality and impact, ensure competition and commercial relevance while also promoting international linkages.

Piloting and learning from experiments with SILs will provide experience that would help to strengthen linkages within the national innovation system and accelerate innovative development at both the national and sub-national levels

Moldova could build on existing 'pockets of excellence' in SILs to experiment with a range of SIL pilots and to subsequently scale up those that work. Successful examples of this already exist in the IT sector, the FEZs, certain knowledge- and technology-based firms as well as in the agri-food supply chain. However, further upscaling of such 'pockets of excellence' would, for example, require more closely linking the IT sector to HEIs, enhancing links between FEZs and the rest of the economy, improving private-sector access to public R&D funding and supporting the transition to higher value-added activities in the agri-food sector to build on the existing collaboration between the R&D sector and food processors, extension service providers and aggregators.

Solid TT institutions, skills and mechanisms would support innovation more systematically

To catch up with other European economies in terms of innovation performance and to capitalize on its existing potential, Moldova needs to ensure that technology and knowledge transfer is facilitated by effective support infrastructure. ***Moldova's innovation and TT infrastructure, both physical and virtual, is new and encouragingly diverse in function and form.*** It includes industrial parks, the FEZs (e.g. the Balti FEZ), sectoral clusters (e.g. the Cahul Creative Cluster), Fablabs (e.g. those in Orhei, Ungheni, Drochia), incubators and accelerators (e.g. the RIAM network of business incubators) and others.

Nevertheless, the infrastructure to support research commercialization (e.g. TTOs) is under-developed. There is a lack of incentives, such as institutional reward schemes embedded in the intellectual property (IP) policies of universities and public research organizations, for researchers to engage in regulated TT activity. There is also a lack of a critical mass of personnel employed within this infrastructure with the skills, know-how and experience to effectively negotiate classic TT through the sale or licensing of rights. Entities with a clear responsibility to protect and transfer IP are generally not currently visible, and the internal regulations to facilitate classical TT, such as institutional IP policies and spin-off regulations, have not been systematically established. This issue is highlighted by the fact that currently, the only Moldovan entity that has an IP policy on the World Intellectual Property Organization (WIPO) website is the Moldova State University.

Streamlining the regulatory environment for TT will create the right incentives and enabling mechanisms. Sector- or region-specific TT mechanisms could help close the rural-urban gap in innovative development and address local socio-economic challenges, building on sub-national capacities and dynamism. ***A national TTO, as well as TT contact points within PROs, could serve to build a robust pipeline of viable projects suitable for support.***

Getting to know and systematically engaging with the Moldovan diaspora could significantly boost innovation dynamics

The diaspora engagement is high on the policy agenda in Moldova and is viewed as a key element of Moldova's development in the "Diaspora-2025" strategy. As examples both in other countries and in Moldova have demonstrated, members of a large diaspora have the potential to bring skills, capital, networks and linkages for innovation and diversification to their homelands.

Overall, the Moldovan diaspora is relatively young, with pre- and post-independence migration complemented by more recent migration flows. Getting to know the diaspora and engaging it systematically calls for, first of all, solid, updated data to provide details on the location, skills, areas of employment and network connections of expatriate Moldovans. This data can be gathered through mechanisms such as voluntary registries and diaspora census exercises.

The Government of Moldova, with the support of the donor community, has created some momentum in this regard already, including initiatives such as the Programme for Attracting Remittances into the Economy (PARE 1+1), the Diaspora Succeeds at Home (DAR 3+1) initiative and the Diaspora Excellence Groups. Many initiatives, however, may not last due to a combination of the lack of long-term funding and wavering trust within the diaspora towards government initiatives. ***Thus, consolidating, leveraging and scaling up existing capacities and mechanisms while drawing and expanding on Moldova's current and past experiences*** would help achieve more systematic and strategic diaspora participation in innovation.

Building trust between the diaspora and Moldovan institutions, coupled with the use of flexible mechanisms for diaspora engagement, should be central to a strategic approach to unlocking the diaspora's potential

Widespread and systematic engagement with the diaspora will turn 'brain drain' into 'brain gain' but will require a clear diaspora policy with concrete support mechanisms. Developing and maintaining flexible-use diaspora engagement infrastructure will help to foster synergies between diaspora development proposals and Moldova's needs (e.g. by setting up a diaspora engagement portal and reinforcing consular contacts). ***A DSG could help develop linkages between Moldovans abroad and scientists, researchers and affiliated groups back home.*** Such a mechanism is currently absent, with most linkages between networks in Moldova and those abroad based on personal connections and ad hoc opportunities.

Finally, ***trust is a prerequisite for diaspora engagement and policies to maintain contact as well as enhance trust between the diaspora and Moldova will be critical to ensure effective and sustainable diaspora engagement.*** This could be achieved through dedicated university and research networks, minimizing the administrative and financial burden of diaspora engagement in initiatives in Moldova, holding events and the like to strengthen the diaspora's cultural connection to Moldova and the systematic engagement of diaspora members in policy processes.

Recommendations

The findings and recommendations of this review complement those of the Sub-regional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus. They are intended to support the Government of Moldova in shaping and improving innovation governance and form the basis for further UNECE assistance.

Table 0.1 Summary of main policy recommendations

Enhancing innovation policy governance
Recommendation 3.1: Reform and complement the institutional and legislative framework for innovation policy based on a broad definition of innovation and the imperative to build and nurture effective innovation systems.
Recommendation 3.2: Strengthen processes and institutional capacities throughout the policy cycle, in particular, regarding stakeholder dialogue and effective policy monitoring and evaluation.
Recommendation 3.3: Enhance policy coordination and alignment across all levels of government to improve the targeting and effectiveness of policy actions.
Recommendation 3.4: Accelerate innovation processes in the public sector through further e-Government reforms and strengthen the demand for innovation via the introduction of an innovation-enhancing procurement framework.
Boosting SILs and commercializing new technology
Recommendation 4.1: Strengthen the demand side of SILs through targeted assistance mechanisms to increase access to and the uptake of research, technology and development (RTD) services in the private sector to enhance the relevance and impact of public R&D investment.
Recommendation 4.2: Strengthen the supply side of SILs by increasing funding for R&D and ensuring an inflow of young researchers within a comprehensively reformed R&D sector.
Recommendation 4.3: Enhance linkages between PROs and the private sector, including companies attracting foreign investment, by aligning private sector needs and commercialization potential with public R&D funding; upgrade IT sector, an existing 'pocket of excellence', through closer links with HEIs.
Developing innovation and TT infrastructure
Recommendation 5.1: Optimize the regulatory environment to address current shortcomings and barriers to developing innovation infrastructure and introducing new products, services and processes to the market.
Recommendation 5.2: Develop sector-specific TT and innovation infrastructure in line with national development priorities and Smart Specialization efforts.
Recommendation 5.3: Support research commercialization through a national TTO and build KT skills at each PRO.
Recommendation 5.4: Adopt a clear regional focus for innovation and TT infrastructure.
Leveraging the diaspora for innovation-driven sustainable development
Recommendation 6.1: Build a nuanced understanding of the composition, location, professions, networks and skills of Moldovans abroad by systematically collecting, updating and analysing statistics and surveys.
Recommendation 6.2: Consolidate, leverage and scale up existing capacities and mechanisms so they reflect international best practices for diaspora engagement while drawing upon and expanding on Moldova's current and past experiences.
Recommendation 6.3: Develop and maintain flexible engagement infrastructure to interact with the diaspora and foster synergies between diaspora development proposals and Moldova's needs.
Recommendation 6.4: Develop linkages between academia in Moldova and Moldovan researchers, scientists and affiliated organizations abroad through the establishment of a DSG.
Recommendation 6.5: Elaborate policies to maintain contact and enhance trust between the diaspora and Moldova while strategically engaging with Moldovans living abroad to benefit the homeland.

Source: The UNECE.

Chapter 1

ECONOMIC OVERVIEW OF MOLDOVA

Main messages

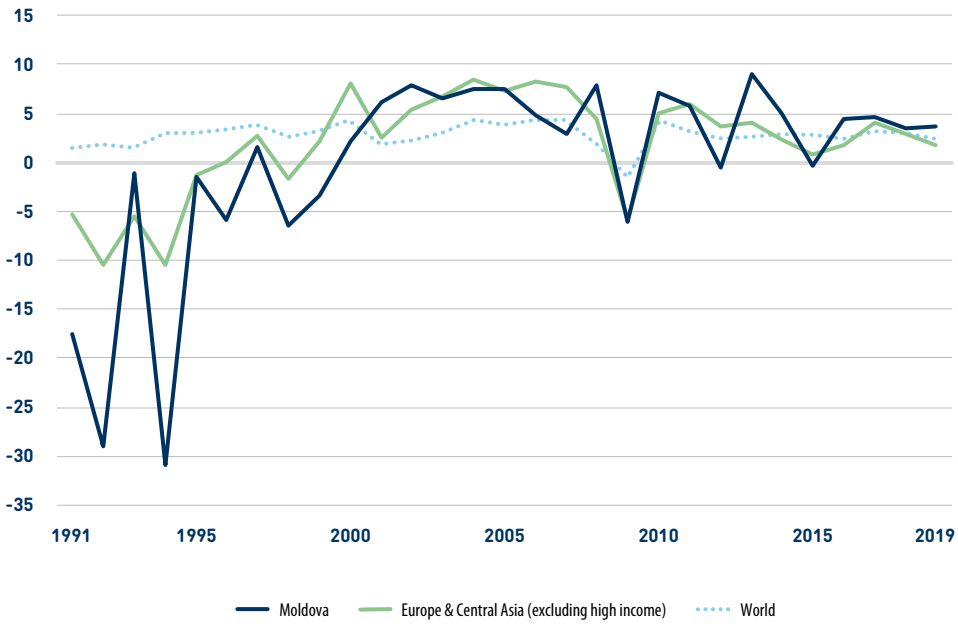
- Moldova has a small but open economy with substantial potential for growth.
- Sustaining and boosting ongoing growth will be challenging as the drivers of growth in the first decades of transition run out of steam.
- Productivity growth has declined and now significantly impacts the economy's competitiveness.
- The Moldovan economy is vulnerable to external shocks, which are key constraints to innovation-led productivity growth.
- Using trade and investment to boost innovation and productivity growth is central to Moldova's economic competitiveness and sustainable development in line with circular economy (CE) principles.
- Innovation is the driving force behind long-term sustainable development.
- Moldova has untapped potential to diversify and increase the value of its exports.
- Foreign direct investment (FDI) levels are volatile, below potential and should be better leveraged to create substantial innovation spill-over effects throughout the broader economy.

Source: The UNECE.

Moldova – a small open economy with substantial potential for growth

Since independence, Moldova has, on the whole, successfully navigated a challenging transition to a market economy. The first decade after independence saw an unprecedented economic slump from which the country recovered slowly. Starting in the early 2000s, Moldova began seeing substantial, albeit volatile, economic growth averaging 4.6 per cent annually (Figure 1.1) and significantly reducing poverty – attaining lower-middle-income status. Rising exports and remittances from Moldovans living and working abroad have counteracted a range of domestic political and economic challenges as well as external shocks to produce an almost unbroken 20-year period of economic growth.

Figure 1.1 · GDP growth (Annual percentage)



Source: The UNECE, based on the UN Statistics database.

While Moldova has economically performed relatively well this century, there are several areas with substantial potential for inclusive growth that remain largely untapped. The country enjoys a strategic location, with easy access to markets in the EU, Turkey and the countries of the former Soviet Union. While domestic reforms over the past decades have removed many barriers to trade and investment with these markets, more could be done. Moldova also possesses several competitive, differentiated and export-oriented areas of production, such as its wine industry. Its Free Economic Zones (FEZs) have demonstrated how new, export-oriented sectors can emerge by introducing relatively straightforward reforms, facilitation mechanisms and diaspora engagement. While the emigration of working-age Moldovans creates economic and demographic challenges, it also creates substantial potential. The country's large diaspora could be harnessed to provide the skills, new ideas, capital and networks necessary to experiment with new ideas and create value, underpinning sustainable growth in the decades ahead.

As the drivers of growth in the first decades of the post-Soviet era run out of steam, transition to a knowledge-driven economy will require new sources of growth

While strong, Moldovan growth has been volatile and has, on average, fallen short of the 6 per cent target laid out in Moldova 2020. At the same time, several indicators suggest that the core drivers of this growth are fading, and that Moldova has failed to fully utilize its inherent potential in many areas. This puts the emphasis on innovation policy to catalyse broad experimentation with ideas for value creation.

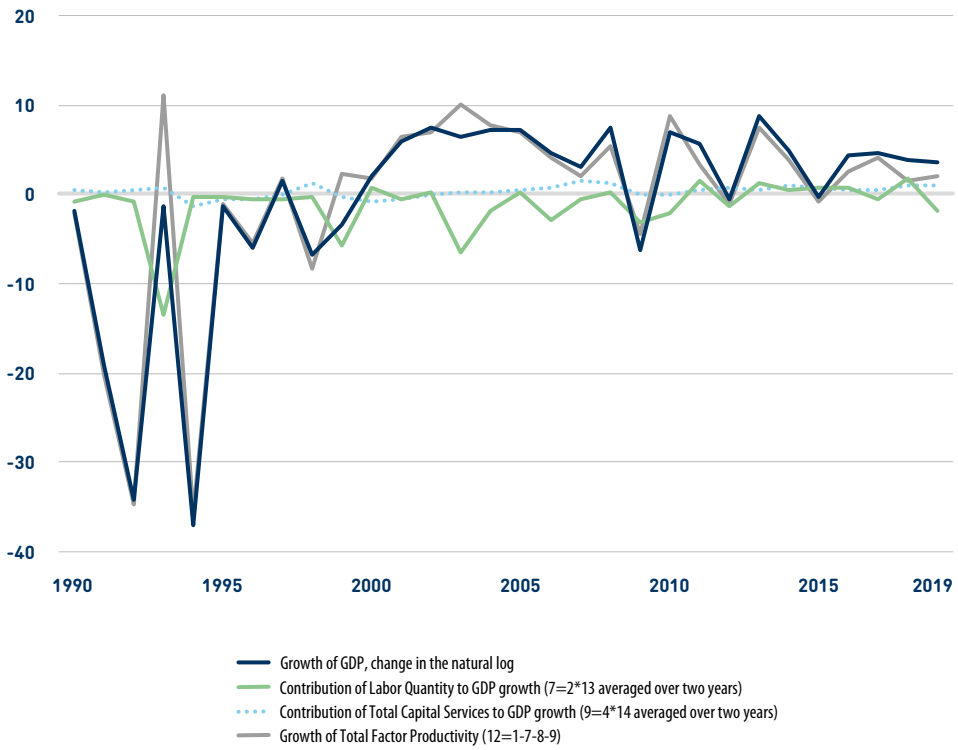
Productivity trends point towards reduced dynamism

Sustained productivity growth has proven elusive for the Moldovan economy. Total factor productivity (TFP) growth is a figure that indicates the improved efficiency with which labour, capital and other resources are put to use through time. Broadly speaking, it is a proxy for innovation, and while this figure in Moldova was respectable in the 2000-2005 period, it has now fallen to less than a third of these levels (Figure 1.2). A significant series of reforms starting in the late 1990s, including land privatization, regulatory simplification and pension reforms, were immediate drivers of increased productivity and led to the steady economic growth seen in Figure 1.1., but have since run out of steam.

To improve and then sustain its TFP, Moldova needs to enable and catalyse broader positive resource allocations – systematically shifting factors of production from less productive to more productive activities. This needs to occur both within a given sector of the economy and between sectors to make use of new market opportunities. This is already happening to some extent, however, the process is far from systematic, as the World Bank study[1] shows. For example, foreign-owned firms have a better productivity performance than domestic ones, potentially explaining the positive TFP growth since 2017. Enhancing the performance of domestic firms to generate better TFP will not be as easy as it was in the 1990s and should be a core concern for innovation and related policies.

The reasons for such difficulty are manifold, such as the fact that the structural reforms now required go beyond the remit of innovation policy. The size of the public sector is a leading constraint as it absorbs and diverts large quantity of resources away from more

Figure 1.2 · Productivity decomposition of economic growth, 1990–2019



Source: The UNECE, based on the UN Statistics database.

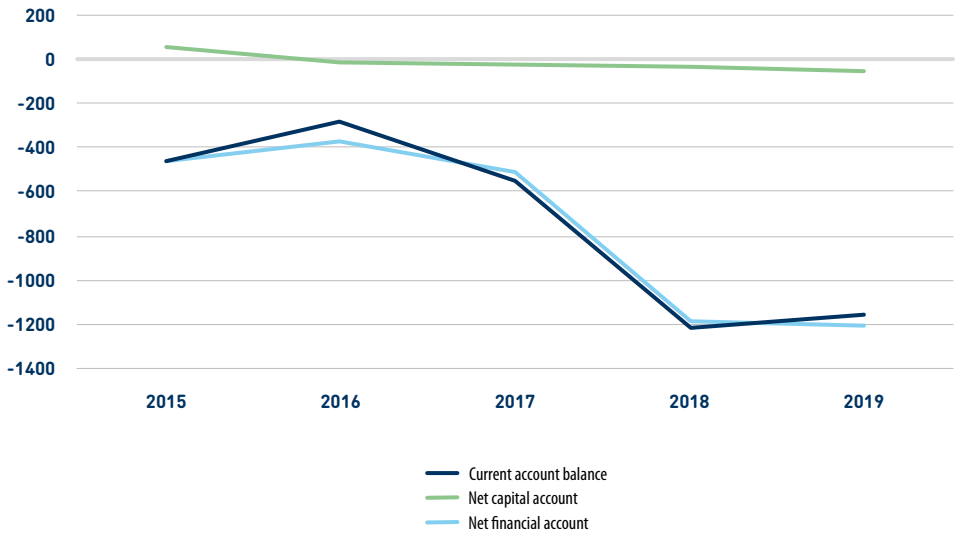
productive uses: with expenditures amounting to 36 per cent of gross domestic product (GDP) in 2016, the public sector in Moldova is 8 percentage points larger than in other lower-middle-income countries. Likewise, state-owned enterprises (SOEs) dominate the productive sectors of the economy but suffer from significantly lower productivity levels than private firms engaged in similar activities – and more than 80 per cent lower than comparable foreign-owned firms.[2]

SOEs often have limited incentives to innovate. High labour taxes discourage expanding employment and risk-taking, while low taxes on consumption discourage savings and capital accumulation. Moldova has put in place a large number of exemptions, often for entire sectors or for SOEs, that have not produced the desired results, including catalysing innovation, and have simply placed a further fiscal strain on the state budget.

Vulnerability to external shocks is a leading constraint to innovation-led productivity growth

On top of this, the Moldovan economy is overly reliant on domestic consumption, driven by government spending and remittances from abroad. This is demonstrated by the country's current account which shows a deficit of USD 1.2 billion (approximately 9.9 per cent of GDP) and a negative rate of gross domestic savings (Figure 1.3). The revenue account also looks increasingly unsustainable, an issue largely attributable to inefficient SOEs and low sectoral productivity.

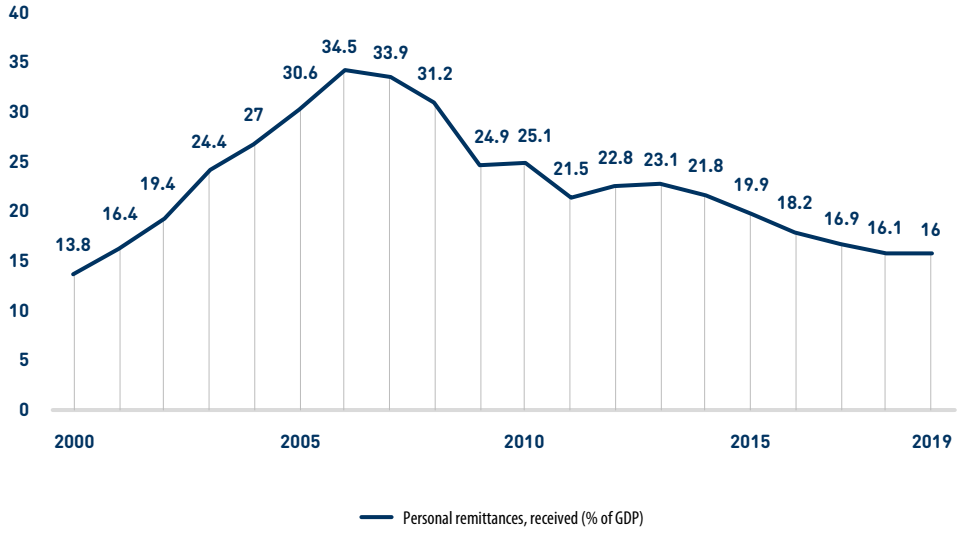
Figure 1.3 · Current account deficit of Moldova, 2015–2019
(BoP, current US$)



Source: The UNECE, based on the World Bank's Development Indicators.

Diaspora remittances contribute significantly to GDP and improvements in living standards but are also a key driver of the current account deficit. Despite their recent decrease to 16 per cent of the GDP (Figure 1.4), remittances have distorting effects on the local market by driving consumption rather than helping to improve productivity levels and employment rates through investment in innovation and infrastructure.

Figure 1.4 · Personal remittances received from abroad as a percentage of GDP, 2000–2019



Source: The UNECE, based on the World Bank's Development Indicators.

This situation is being aggravated by changes in Moldova's demographics due to significant ongoing emigration of young adults, an ageing population and diminishing birth rates. These factors also generate considerable risk for the social security system, which will face acute financial pressure in the short- to medium-term should large numbers of emigrants return once they reach pension age.

Using trade and investment to boost innovation and productivity growth is vital

As a small country, Moldova is heavily dependent on trade. Recognizing this, the country has gone through substantial reforms to open up the economy, joined the WTO in 2001, signed the Deep and Comprehensive Free Trade Agreement (DCFTA) with the EU in 2014 and has free trade agreements (FTAs) with more than 40 countries, including Commonwealth of Independent States (CIS) countries, the United States and Japan. In parallel, Moldova has worked hard to improve its regulatory environment – between 2013 and 2020 it went from 83rd to 48th in the rankings of the Doing Business Index.[3] Further reforms, however, are needed to realize opportunities from trade and investment, especially in the areas of minority investors protection, insolvency regulations, contract enforcement and construction procedures.

Moldova has untapped potential that would allow it to diversify and increase the value of its exports

As a result of trade reforms, Moldova has achieved high trade volumes with imports and exports in 2019 amounting to 87.4 per cent of GDP contributions, outperforming Turkey (62.7 per cent of GDP) and Russia (49.1 per cent of GDP).

At the same time, the current trade structure shows some worrying trends. First of all, Moldova's trade deficit is high and growing and which, in turn, is resulting in ever-increasing private and public debt. The economy importing significantly more than it exports has only been sustainable to this point because of volatile remittance inflows, on which the country is now highly dependent. Second, most exports are concentrated in areas with low economic complexity and value-added, such as insulated wire and agricultural outputs (Figure 1.5). According to World Bank Development indicators, only 3 per cent of Moldova's total manufactured exports were categorized as high-technology exports in 2019 – one of the lowest rates among comparator countries. Furthermore, this is a growing area of concern as diversification and, most importantly, the complexity of Moldovan exports is declining since 1990 – revealing deterioration of export specialization in relative terms.[4]

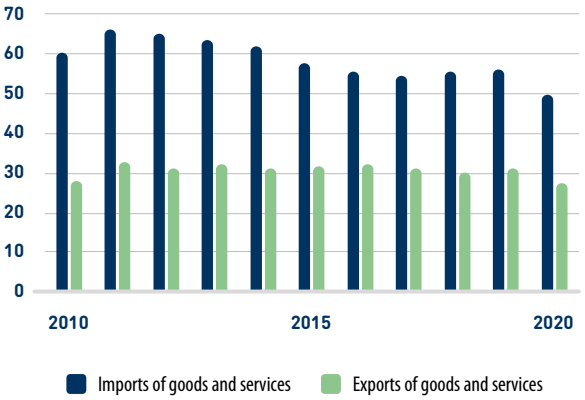
Trade in services is far below potential and, although this contributed more than half of its economic growth, Moldova is behind its neighbours in the region (Figure 1.6). In 2019, Moldova's main exported services were transport (26.7 per cent), travel (25.8 per cent), information and communication technologies (ICT) and other business goods-related services (47.5 per cent).[5]

FDI is volatile, below potential and, in many cases, unlikely to create substantial innovation spill-over effects

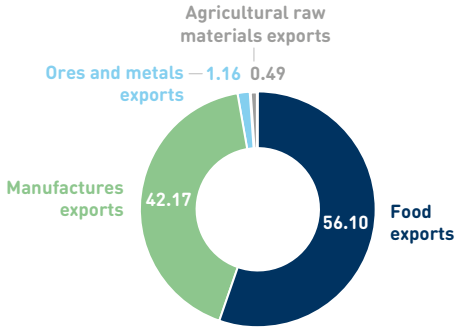
After a period of growth in the first decade of the century, FDI slowed dramatically following the global financial crisis in 2009 (Figure 1.7). Subsequent events, such as an economic slump in Russia and the 2014 banking crisis, have made Moldova a more

Figure 1.5 · Trade and merchandise exports of Moldova

a. Imports and exports
(% of GDP, 2010–2020)

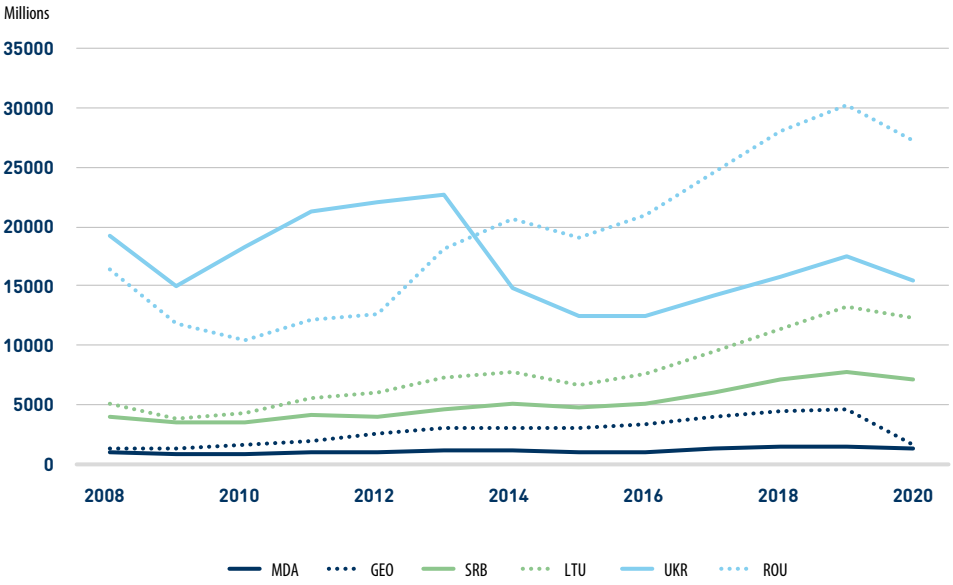


b. Merchandise exports decomposition, 2019
(as % of merchandise exports)



Source: The UNECE, based on the World Bank's Development Indicators.

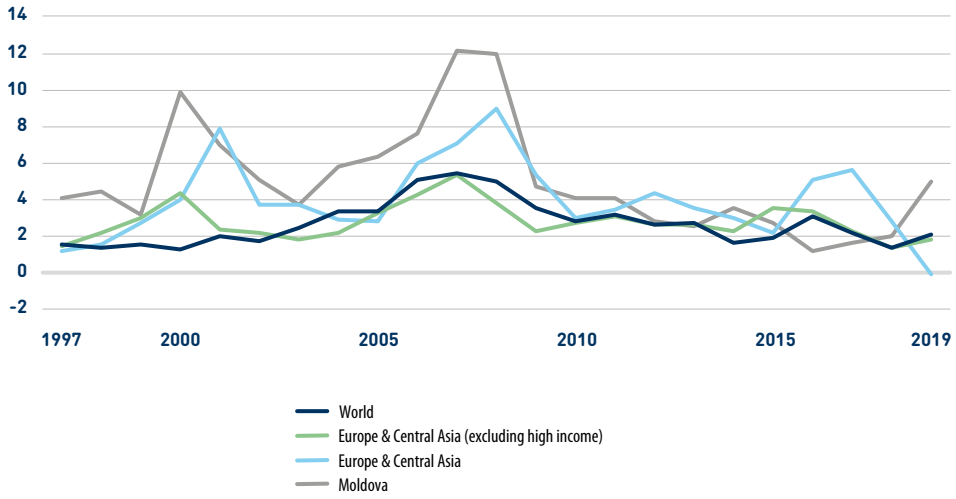
Figure 1.6 · Service exports, 2008–2020 (BoP, current USD)



Source: The UNECE, based on the World Bank Development Indicators.

daunting market for investors.[6] This reluctance seems to have persisted despite several important reforms to address the concerns of foreign investors. The Heritage Foundation's 2021 Index of Economic Freedom scored Moldova's investment freedom as 55 out of 100, 100 indicating the economy is mostly free or the best performance, with Georgia reaching 80 on this indicator, for comparison.[7] This is due to a range of regulatory constraints, a lack of investor protection, cumbersome labour and product market regulations as well as shallow financial intermediation.

Figure 1.7 · Foreign direct investment, net inflows
(Percentage of GDP)



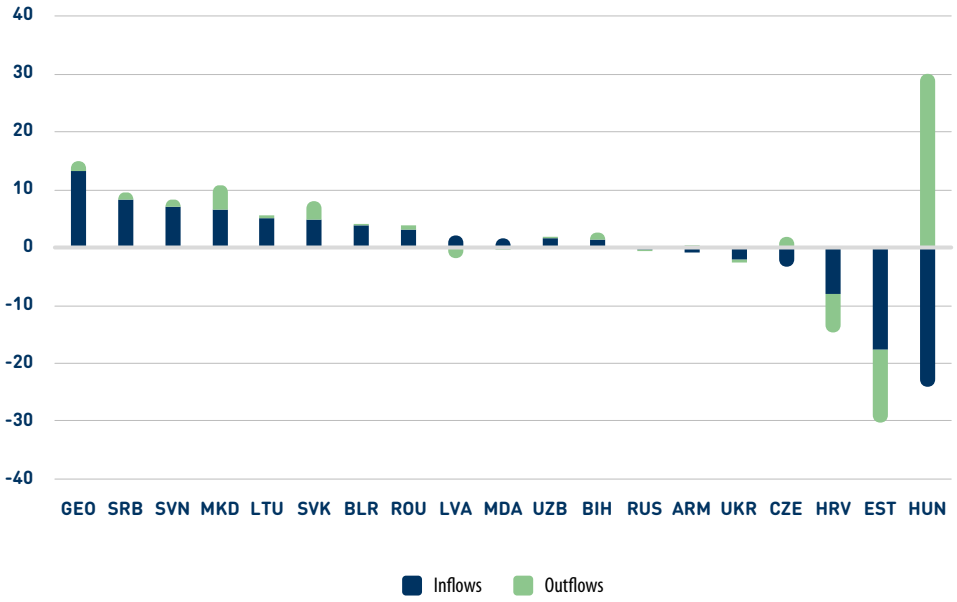
Source: The UNECE, based on the World Bank's Development Indicators.

Foreign firms in Moldova are among the most productive entities in the economy, driving productivity gains and rising incomes over the past decades while outperforming domestically owned and operated firms in the private sector by 60 per cent and SOEs by 80 per cent.[8] This should bring ample potential for positive spill-over effects from the foreign firms, in the form of skills, ideas, linkages, supply opportunities and technology transfer, to the local firms and therefore the broader economy. However, these positive spill-overs are not systematically emerging in Moldova.

After concluding the Deep and Comprehensive Free Trade Agreement (DCFTA) with the EU in 2014, Moldova obtained access to the European Single Market along with the opportunities it offers to join various EU industrial networks and be integrated into EU supply chains. However, as net FDI inflow[9] and outflow[10] data show, these opportunities have not yet been fully exploited. The scale of these missed opportunities can be seen in results enjoyed by Georgia, which is also a member of the DCFTA: Moldova's net FDI inflows for 2014-19 were 1.84 per cent of GDP, for Georgia this figure is 13.4 per cent. Furthermore, a negative value of 0.41 per cent of GDP for net FDI outflow shows that domestic investors' direct investment abroad was less than the value of repatriated (disinvested) direct investment from abroad. This suggests that domestic investors going abroad are not expanding operations.

Not only are net FDI inflows modest compared to neighbouring countries – Moldova also has the lowest number of greenfield projects, i.e. a type of FDI where a parent company creates a subsidiary in a different country, building its operations from the ground up.[11] This means that most FDIs in Moldova take the form of acquiring stakes in existing companies, often former SOEs, rather than investments into new, productive and export-oriented businesses. Furthermore, most of the limited number of greenfield projects in Moldova have been market- or resource-seeking. This means that investments were made to find and exploit existing resources or fill supply gaps in local

Figure 1.8 · Average FDI net inflows and outflows as a percentage of GDP, 2014–2019[a]



Source: The UNECE, based on the World Bank's Development Indicators.

[a] FDI net inflows are the value of inward direct investment made by non-resident investors in the reporting economy. FDI net outflows are the value of outward direct investment made by the residents of the reporting economy to external economies. Negative values for FDI net outflows show that the value of direct investment made by domestic investors to external economies was less than the value of repatriated (disinvested) direct investment from external economies. Negative values of FDI net inflows for a particular year show that the value of disinvestment by foreign investors was more than the value of capital newly invested in the reporting economy.

markets in response to local consumer demand without any substantial contribution to export diversification, employment, capacity accumulation or innovation.. Overall, Moldova's FDI Complexity Index, a weighted average of the Product Complexity Index of the relevant industry and FDI contributions, is above that of the Economic Complexity Index overall, indicating a lack of dynamic interaction with the rest of the economy over time.

A positive development in the area of FDI has been the FEZs in Moldova. The first of these zones was established in 1995 and, currently, there are seven across the country. These zones offer, among other services, a programme of streamlined export processing which is not only attracting a growing share of Moldovan FDI but has also sparked the development of new sectors in the economy, such as automotive supplies. This shows that even without substantial government support, marginal improvements in regulation, export processing and investor protection could trigger similar dynamics in other sectors and the rest of the economy.

Innovation emerges as the driving force behind long-term sustainable development

As this chapter has outlined, more fully harnessing the economic potential of Moldova will be essential to both increasing and sustaining inclusive growth, in line with the principle of "leaving no one behind" and sustainable development more broadly. This, in turn, requires widespread innovation within and across economic sectors,

a process that involves increased systematic experimentation with new ideas to create value and find out what works and what does not. Most of this potential will be realized in incremental innovation, largely by absorbing and adapting ideas that have proven their value elsewhere.

While there are several pockets of excellence where such innovation does occur, notably in the automotive and wine sectors, it is the responsibility of policymakers to encourage and provide the initial catalysts for similar dynamics across the economy and throughout society. In addition to a range of structural reforms outside the immediate remit of innovation policy, such as simplifying and reorienting taxation, reforming and privatizing SOEs as well as improving infrastructure, there is clear justification for limited, low-cost but targeted and effective vertical policies to minimize the risks of innovation and ensure that businesses engage in innovation more than they otherwise would.

As a result, a central theme in this publication is the imperative to implement effective innovation policy and support the relevant institutions. The latter is a key component as they can play a leading role in addressing research funding, house high-technology start-ups, enable and promote innovation across the economy and assist in the governance of innovation. Promoting experimentation, ensuring cross-sectoral knowledge transfers and using technology, FDI, as well as export opportunities to maximum effect, should be focal points for the Government. If these challenges can be met while also investing in hard and soft infrastructure to facilitate all of the above, Moldova will establish a pattern of long-term, sustainable development. To further explain and develop some of the topics discussed here, the next chapter will discuss the impact of economic policy on innovation performance.

Table 1.1 Overview of the main strengths of and challenges to Moldova's economic performance

Strengths and opportunities	Next development milestones
• Strategic location. • Large potential for trade and investment. • Several areas of internationally competitive, complex production. • High levels of education and multi-lingual labour force (Russian, Romanian and, increasingly, English). • A large diaspora that could inject skills, networks and capital into the Moldovan economy. • Competitive wage levels. • Some success stories emerging from the FEZs highlight the value of extending reforms to provide immediate benefits.	• Boost productivity by removing distortions and encouraging innovation. • Diversify and increase the complexity of production, especially for export-oriented products and services. • Make better use of potential trade opportunities and Moldova's strategic location, especially for trade in services. • Attract foreign investment, in particular into greenfield projects and market-seeking opportunities with large potential for innovation-related spill-over effects. • Improve hard and soft infrastructure, especially transport and education, to lower the costs of trade and provide the right skills in the labour market. • Enable and catalyse linkages in the economy, especially with foreign companies. • Put in place a strategic approach to better utilize the largely untapped potential of the Moldovan diaspora.

Source: The UNECE.

Table 1.2 Basic macroeconomic indicators of the Republic of Moldova, 2020

Population

Total (millions)	2.6*
Major city: Chisinau (population in millions)	0.7
Urban dwelling population (% of total)	42.8

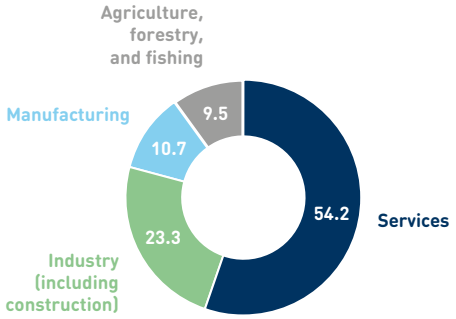
Natural resources

Land area (square kilometres)	32.9
Agricultural land usage (% of land area)	74.8

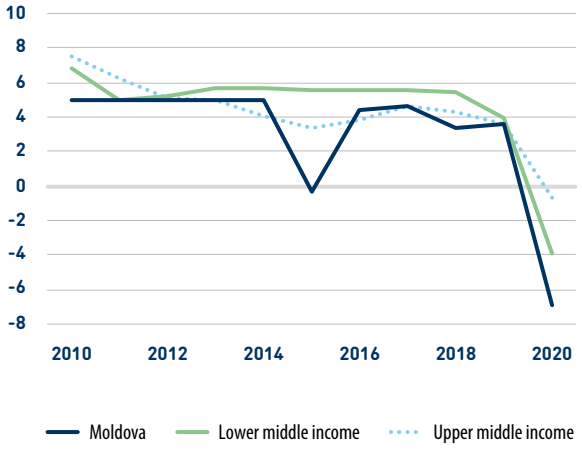
GDP

In billions of USD	11.9
USD income per capita, PPP	13
GDP growth (annual)	-7

Value added (% of GDP), 2020



GDP growth (annual, %)



Private sector**

SMEs contribution to GDP (%):	49
Trade, repair, accommodation and food services	20.2
Agriculture, forestry, fishing	6.1
Information and communication	2.2
Share of enterprises located in Chisinau (% of the total business sector)	62
New business density (new registrations per 1 thousand population ages 15-64)	1.9

Trade

Trade (% of GDP)	77
Exports of goods and services (% of GDP)	27.3
Imports of goods and services (% of GDP)	49.7
High-tech exports (% of manufactured exports)	3**
ICT service exports (% of service exports)***	13.9

Major export markets

Romania, Italy, Germany, Russia, Poland

High-technology exports (% of manufactured exports), 2019

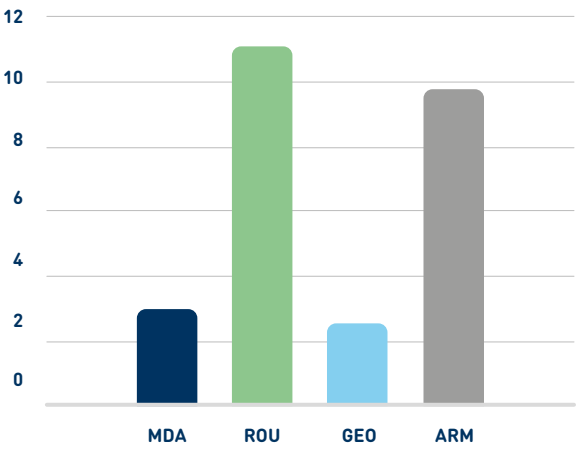


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Table 1.2 **Basic macroeconomic indicators of the Republic of Moldova, 2020**
(Concluded)

Macroeconomic environment		Labour market	
Current account balance (% of GDP)	-6.7	Employment rate (% total population ages 15+), ILO estimate	39.6
Tax revenue (% of GDP)	17.3**	Unemployment rate (% of the total labour force), ILO estimate	4.7
Inflation (CPI, annual %)	3.8	Share of the labour force with advanced education (% of the total working-age population with advanced education)	63.4**
FDI net inflows (% of GDP)	4.2**		
Real interest rate (% of GDP)	2.6		
Gross savings (% of GDP)	17	Knowledge-intensive jobs (% of total jobs)	24
Remittances (% of GDP)	15.7		
Fixed assets owned by the State (% of overall fixed assets)	48**		

Source: The UNECE, based on the World Bank`s Development Indicators and the National Bureau of Statistics of Moldova.
Notes: *According to the NSO, based on 2014 census data; unofficial statistics claim around 4 million; **Latest available data for 2019; *** Latest available data for 2017.

Notes

1 World Bank. (2019). *Moldova, Rekindling Economic Dynamism*. Washington DC: World Bank Publications
2 Ibid
3 World Bank Doing Business Report 2020 available at http://documents.worldbank.org/curated/en/688761571934946384/pdf/Doing-Business-2020-Comparing-Business-Regulation-in-190-Economies.pdf
4 World Bank. (2019). *Moldova, Rekindling Economic Dynamism*. Washington DC: World Bank Publications
5 Estimations based on Moldova's WTO profile https://unctadstat.unctad.org/CountryProfile/GeneralProfile/en-GB/498/index.html
6 https://emerging-europe.com/interviews/restoring-trust-in-moldovas-banking-sector/
7 Data from the 2021 Index of Economic Freedom, available at https://www.heritage.org/index/country/moldova
8 World Bank. (2019). *Moldova, Rekindling Economic Dynamism*. Washington DC: World Bank Publications
9 FDI net inflows are the value of inward direct investment made by non-resident investors in the reporting economy, including reinvested earnings and intra-company loans, net of repatriation of capital and repayment of loans.
10 FDI net outflows are the value of outward direct investment made by the residents of the reporting economy to external economies, including reinvested earnings and intracompany loans, net of receipts from the repatriation of capital and repayment of loans.
11 Definition from Investopedia available at https://www.investopedia.com/terms/g/greenfield.asp#:~:text=A%20green%2Dfield%20(also%20%22,operations%20from%20the%20ground%20up

Chapter 2

INNOVATION PERFORMANCE OVERVIEW

Main messages

- Despite reforms to promote innovaton and entrepreneurship, there is limited systematic innovation across the economy.
- A leading constraint to innovation is the limited ability of the private sector to innovate as firms have inadequate absorptive capacity.
- Limited firm absorptive capacity also appears to constrain positive spillover effects from trade and investment flows.
- Enhancing the private sector's overall absorptive capacity is crucial to innovative development and, in particular, to promoting innovative entrepreneurship.
- Forging and incentivizing science-industry linkages is an important step to boosting innovation.
- In addition to addressing the above issues, establishing the right incentives to align the education system with market needs is essential to address the widely reported skills mismatch.

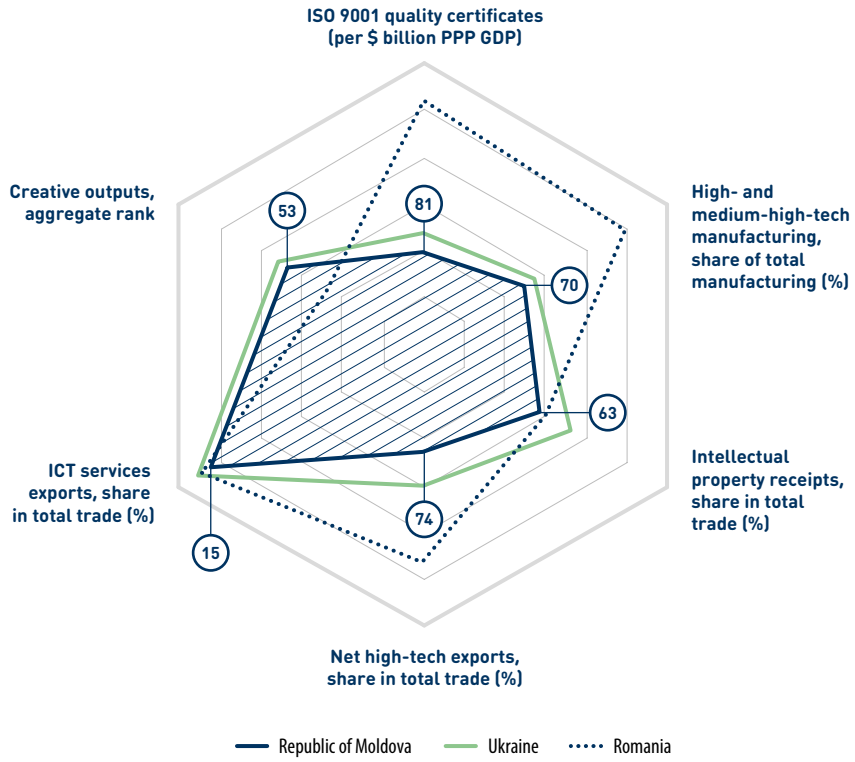
Source: UNECE.

Despite reforms to promote innovation and enterpreneurship, Moldova sees little systematic innovation across the economy

After two decades of reforms, Moldova has radically improved the environment for business and innovative entrepreneurship, particularly by simplifying regulations and opening up the economy to trade and investment.

This has, however, yet to fully realize the ambition of systematically boosting innovation. In the context of this report, successful innovation would require widespread experimentation with new ideas to bring novel or improved products, services, business models and production methods to the market. This view of success is largely based on past experience from around the globe where widespread innovation has been the main driver of long-term productivity gains, sustained economic growth and a cornerstone of sustainable development. Figure 2.1 shows that output indicators as assessed by the Global Innovation Index 2021, such as the high-tech share in manufacturing output and exports, remain relatively low for Moldova despite substantial progress in areas such as information and communication technology (ICT) service exports and an overall solid performance on creative outputs, intangible assets (e.g., trademarks, industrial designs), creative goods and services (e.g., entertainment and media market), including those online (e.g., top-level domains, mobile applications). These and other indicators point to the ongoing need to maintain reform momentum and further improve fundamental inputs into innovation, such as soft and hard infrastructure[1] and address the weaknesses in the national innovation system, as discussed in Chapter 3 and in line with the findings of the UNECE (2020), Sub-regional Innovation Policy Outlook: Eastern Europe and the South Caucasus.[2] (Box 2.1).

Figure 2.1 · Innovation performance by selected Global Innovation Index indicators, 2021 (ranks)



Source: The UNECE, based on the Global Innovation Index, 2021.

Box 2.1 A circular economy for sustainable development

A circular economy (CE) may be broadly defined as an economic model where the value of products, materials and resources is maintained in an economy for as long as possible – in stark contrast to the traditional, linear economy model of 'take-make-dispose'. The circular model is restorative and regenerative by design, enhancing and preserving natural capital, optimizing resource yields and minimizing systemic risks by managing inputs and outputs into renewable flows. The ultimate goal of a CE is that economic growth takes place by using finite resources more efficiently and sustainably, with the transition to a CE involving a move away from resource-intensive processes that cannot be maintained while optimizing the use of existing assets and the creation of new revenue streams.

Innovation is central to any transition to a CE, as the latter requires new approaches to value creation and consumption that entail improvements to existing and the creation of new products, services and processes. There are already numerous CE-centred innovations that are being adopted and adapted in various parts of the globe to transition away from linear economies. These new technologies, processes, services and business models are re-shaping product life cycles by employing improved design, enhanced production processes and usage as well as inventive means of re-cycling and, eventually, disposal for products at their end-of-life. In April 2021, the Economic Commission for Europe dedicated its 69th session to the promotion of a circular economy and sustainable use of natural resources in the UNECE region. As a result, decision B(69.) saw the Member States commit to stepping up efforts to promote a circular economy and the sustainable use of natural resources.

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Box 2.1 A circular economy for sustainable development (Concluded)

In Moldova, despite the partial transposition of EU directives related to a CE into national legislation, including the National Waste Management Strategy 2013-2027, current domestic legislation still fails to clearly define and regulate a model of production and consumption focused on the sustainable consumption of resources and efficient waste management in line with the envisioned CE model.

With its rich soil and moderate, continental climate, intensive agriculture has placed significant pressure on the environment in Moldova through the excessive use of pesticides, contributing to both soil erosion and water pollution as well as generating considerable waste from various food production processes. Furthermore, while the agricultural sector is an important employer in the economy, employing 32 per cent of the workforce, it only comprises 13 per cent of GDP.[a] Ensuring sustainable agricultural practices should therefore be among the key policy priorities when it comes to achieving the Sustainable Development Goals (SDGs) and the transition to a CE, with substantial benefits for Moldova's competitiveness and the wellbeing of its citizens.

Putting in place the right incentives while eliminating barriers that impede a transition to a CE through policy action, particularly in the areas of entrepreneurship and agriculture, is the most promising path forward for Moldova. Supporting SME greening in partnership with the EU4Environement initiative is a good first step in this direction. Given the size of the agricultural sector in Moldova, organic farming has great potential to contribute towards establishing a CE, however, there is a lack of enabling legislative and institutional frameworks and business awareness of the opportunities that organic farming presents are limited . Action to promote a transition to a CE in waste management has been undertaken by the Association of Waste Recovery of Moldova. It is a member of the global CE network Circular Economy Club and, in 2019, with financial support from the EU and the Global Environment Facility (GEF), implemented projects for the collection of waste from electrical and electronic equipment (WEEE) as well as discarded plastics, which are both re-usable as secondary raw materials in new production chains (UNIDO, 2020).

Going forward, it would be important for the Government to explore the opportunities a CE offers for innovation, competitiveness, economic growth and sustainable development in line with the UN Agenda 2030.

Source: The UNECE, based on (EU4Environment , 2019) (UNIDO, 2020).
[a] EU4Environment (2019), *A partnership for green development in Moldova*.
[b] https://unctad.org/system/files/non-official-document/ditc-ted-08102018-nger-forum-Moldova-2.pdf
[c] https://www.circulareconomyclub.com/about/
[d] UNIDO (2020), *Regional preparatory meeting for the Eastern European Group for the UNIDO global consultations on circular economy*.

A leading constraint to innovation is the limited innovative ability of the private sector stemming from firms' low absorptive capacities

The private sector is an essential actor in Moldova's efforts to make its economy more innovative, this is because innovative high-growth enterprises (IHGEs) are the main agents that look for, test, commercialize and scale up new ideas throughout the economy and society (see Box 2.2), drawing on the manifold opportunities available as discussed in other chapters.

The Moldovan private sector would benefit if they could more fully take advantage of this potential. Government reforms have already improved the regulatory environment, with Moldova ranking 48th in the World Bank 2020 Doing Business Report and largely in line with its regional neighbours[3], however, new business creation remains an area of concern (Figure 2.2).

Box 2.2 IHGEs as drivers of innovation-led growth and sustainable development

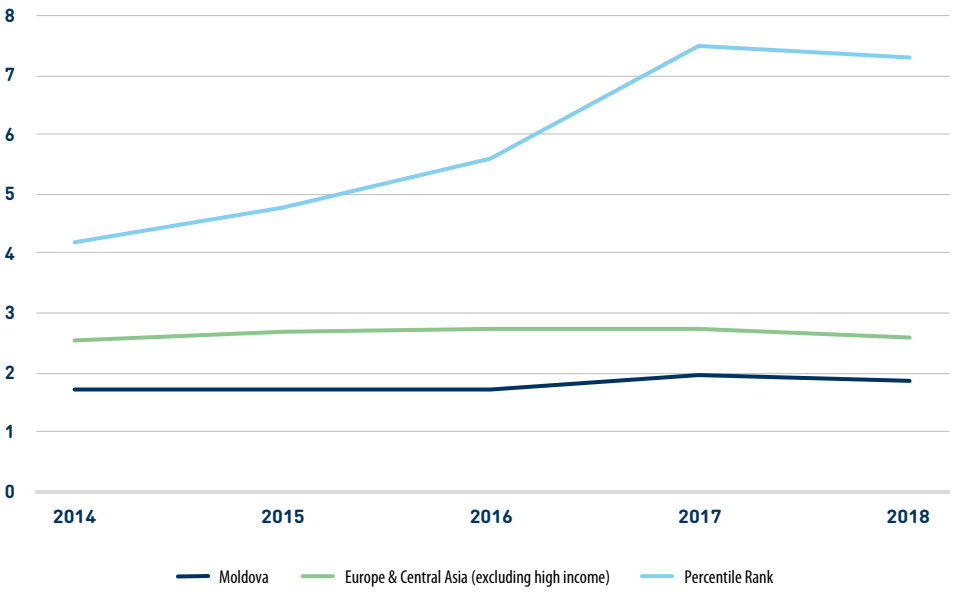
The small group of IHGEs, which are only 2 to 6 per cent of the business population, plays a disproportionately significant role in implementing innovation within Moldova's economy. These transformational entrepreneurs drive and help systematize the processes of experimentation with ideas as they respond to emerging opportunities and challenges that are at the core of innovation-led development in Moldova and elsewhere. In the aftermath of the COVID pandemic, shrinking fiscal resources coupled with rapid technological change means that promoting IHGEs in a targeted, cost-effective fashion is especially important for Moldova.

Such a targeted approach should build on a nuanced understanding of the needs, dynamics and characteristics of IHGEs in Moldova – especially as they can differ substantially from that of the business population as a whole. The UNECE has developed a handbook to support policymakers in the European Economic and Social Committee (EESC) to design effective policies and institutions in this regard.

Source: The UNECE, based on (EU4Environment, 2019) (UNIDO, 2020).[a]

[a] UNECE (2021), *Supporting Innovative High-Growth Enterprises in Eastern Europe and South Caucasus* available at https://unece.org/economic-cooperation-and-integration/publications/supporting-innovative-high-growth-enterprises

Figure 2.2 · New business density (Registrations per 1,000 people ages 15–64)



Source: The UNECE, based on World Bank`s Development Indicators, 2019.

Having said that, innovation-led growth is not as directly tied to the creation of businesses as it is to the creation and growth of businesses that actively innovate. This latter group have a strong focus on absorbing and adapting new ideas for products, services and business models that have proven successful elsewhere.

While this absorptive capacity is difficult to measure precisely, several indicators show that private-sector innovation in Moldova is far below what is required to have meaningful impacts on the broader economy. Survey data, despite being somewhat imprecise and incomplete, shows that very little domestic innovation is taking place. According to National Statistics Bureau data[4], 18 per cent of respondents[5] have introduced new products, processes or marketing and organizational methods in 2017-2018. The majority of these come from industry (52 per cent) while firms offering services, mostly active in wholesale trade and a few in the information technology (IT) sector, pointing to the substantial potential for innovation in those areas. These results, together with the outcomes from the 2019 European Bank for Reconstruction and Development's Business Environment and Enterprise Performance Survey (EBRD BEEPS V)[6], reflect largely the tendency of firms to report minor improvements, such as redesigned web pages, enterprise resource planning systems and upgraded computer networks as innovation[7].

The picture is more pronounced when looking at other proxies for private sector absorptive capacity. Moldovan private-sector R&D expenditure, at less than 0.01 per cent of GDP, is marginal, the lowest in the European and Central Asian region and most probably concentrated in a few large, often state-owned firms and foreign-owned subsidiaries rather than among a more diverse group of IHGEs[8]. A useful proxy for assessing the degree of professionalization is the use of standards and intellectual property registration. Data on ISO9000 certificates[9] and trademark applications per million of the population place Moldova at the bottom of its group of comparator economies.

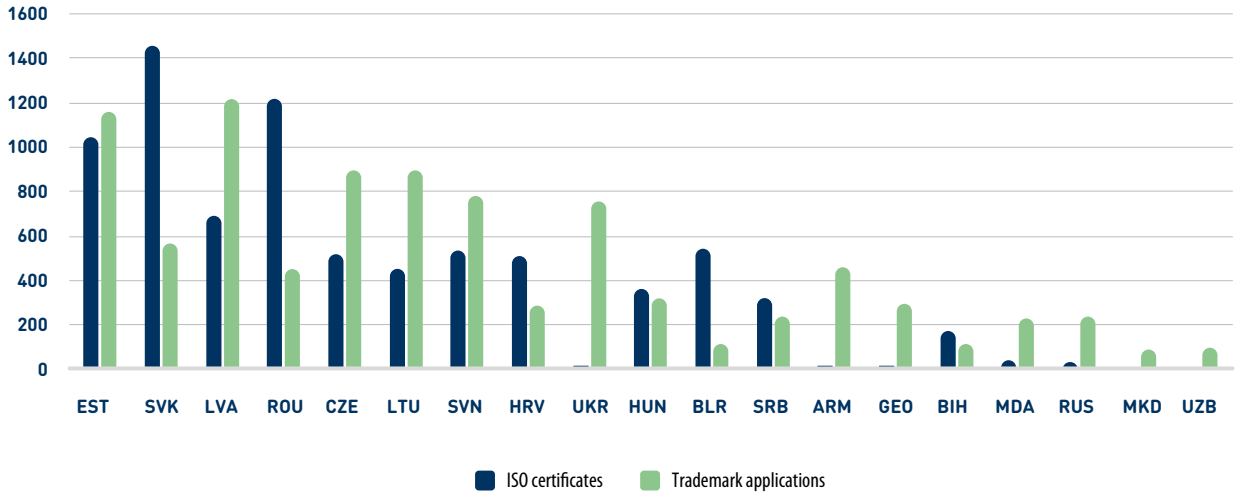
Low firm absorptive capacity also appears to constrain the positive spillover effects from trade and investment flows

Leading drivers for innovation are the skills, linkages, demand incentives and knowledge absorption brought about by trade, value-chain integration and foreign investment. Despite Moldova enjoying substantial trade and investment flows, very little dynamic to innovate has been created through knowledge and skills flows into the economy, except for a few examples in information and communication technologies (ICT) services and the automotive sector (see Chapter 1). A similar picture, as discussed in Chapter 4, emerges when looking at research cooperation and supply chain integration. In fact, even in those instances where Moldovan firms operate within international supply chains, this tends to take place with a strong dependence on value-chain partners with weak links to the local firms. While ICT export-oriented services and the automotive supply sector are partial exceptions, the private sector's low level of absorptive capacity (see Box 2.3) limits not only further development of those sectors but also innovative dynamics emerging elsewhere in the economy.

Forging and incentivizing business-science linkages is an important step to boost innovation

Although R&D expenditure has fallen and is at a low level compared to its neighbours, Moldova has ensured some funding for research at public research organisations (PROs) over the the last decade with the recent introduction of competitive public funding of R&D projects through the National Agency on Research and Development (see Chapter 3 and 4 for details) (see Figure 2.4). Much of this funding flows to applied research with potential for commercialization (see Figure 2.5).

Figure 2.3 · ISO certificates, and Trademark applications, 2015–2019



Source: The UNECE, based on the Global Innovation Index, 2020.

Box 2.3 What is a firm's absorptive capacity and why is it important?

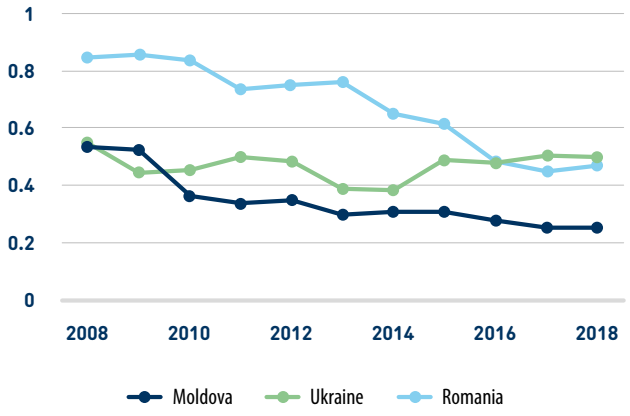
A firm's absorptive capacity refers to the "ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends". Building such capacity is especially important for transition economies as most innovation involves absorbing, adapting and rolling out initiatives based on new ideas, business models and technologies that have proven their value in other countries or economic sectors.

Source: The UNECE, based on (Cohen W.M., Levinthal D.A., 1990).[a]

[a] Cohen W.M., Levinthal D.A. (1990), *Absorptive capacity: A new perspective on learning and innovation*, Administrative Science Quarterly, pp. 128-152.

Figure 2.4 · Research and development expenditure, 2008–2018

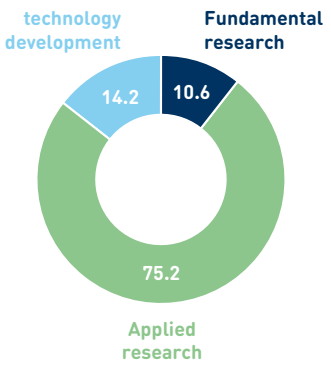
(As a percentage of GDP)



Source: The UNECE, based on UNESCO database http://data.uis.unesco.org/Index.aspx#

Figure 2.5 · The structure of current expenditures in R&D by types of research, 2020

(As share of total expenditures)



Source: The UNECE, based on the National Bureau of Statistics of Moldova, 2020.

Nevertheless, there have been very few instances where public research investment in Moldova catalysed innovation through commercializing research results or by focusing research on specific private-sector demands for solutions. The underlying reason for this is the low level of linkages between science and the private sector (Figure 2.6), the topic of Chapter 4. Through the transfer and commercialization of new knowledge and technology, businesses can develop new or improved products, services and production processes to increase both their domestic and international competitiveness.

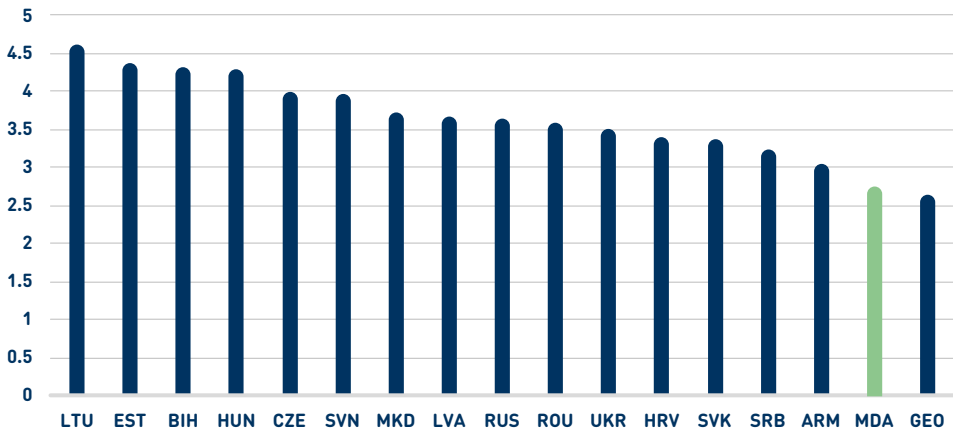
The H2020 Peer Review of the Moldovan Research and Innovation system[10] notes that "the situation of the human resource capacity for R&I in Moldova is alarming" (see Box 2.4). With the high average age of researchers, difficulties to retain young talent and scarce state R&D funding, the Government of Moldova should take action to utilize the excellent local human capital potential and provide policy solutions that would improve the outputs of the R&D system to improve the country's competitiveness and further its socioeconomic development.

Having the right incentives to align the education system with market needs is essential to address the widely reported skills-mismatch

Human capital, or in other words skills, both technical and managerial, are at the heart of any successful business innovation. Without the right mix of skills, enterprises cannot effectively absorb new knowledge or develop new products, services and business models.

The lack of access to the right skills is holding back innovation in Moldova. The 2019 EBRD BEEPS V[11] puts this skills mismatch at the top of the list of constraints to doing business in Moldova with 20 per cent of firms reporting it as a problem (versus the average of less than 10 per cent in the Europe and Central Asia comparator group). This issue exists to an even greater degree for innovative enterprises that struggle to access and retain the human capital required to allow their operations to innovate and evolve.

Figure 2.6 · University-industry collaboration in R&D: Ratings are 1 (poor) to 7 (best), 2019



Source: The UNECE based on the World Bank TCdata360.

Box 2.4 The overview of results of the peer review of the Moldovan Research and Innovation system conducted under the European Union Horizon 2020 Policy Support Facility in 2016

The peer review of the Moldovan Research and Innovation system was conducted under the European Union Horizon 2020 Policy Support Facility in 2016 and identified seven policy areas for improvement with corresponding recommendations, namely:

1. Embed research and innovation (R&I) policy in the overall economic policy strategy of the country.
2. Improve political governance of the national R&I system by assigning specific responsibilities to specific ministries.
3. Create an independent, transparent and accountable R&I implementation agency that concentrates and allocates all available R&I funding based on international standards.
4. Redress the binary research and education system of Moldova, whereby universities focus mainly on "teaching" and institutes on "research".
5. Safeguard the public R&I capacity of Moldova by ensuring that the physical, intellectual and human capital of its research institutions is maintained and reinforced.
6. Take resolute action to improve employment and funding opportunities, working conditions and career prospects of researchers, notably including both young and female scientific talents.
7. Introduce a coherent set of policy measures to create and stimulate a supportive environment for business engagement in R&I activities, including both non-financial tools (a legal environment supportive of spin-offs and knowledge transfers as well as better opportunities to fund high-risk projects) and increase the use of public funds to leverage business R&I activities.

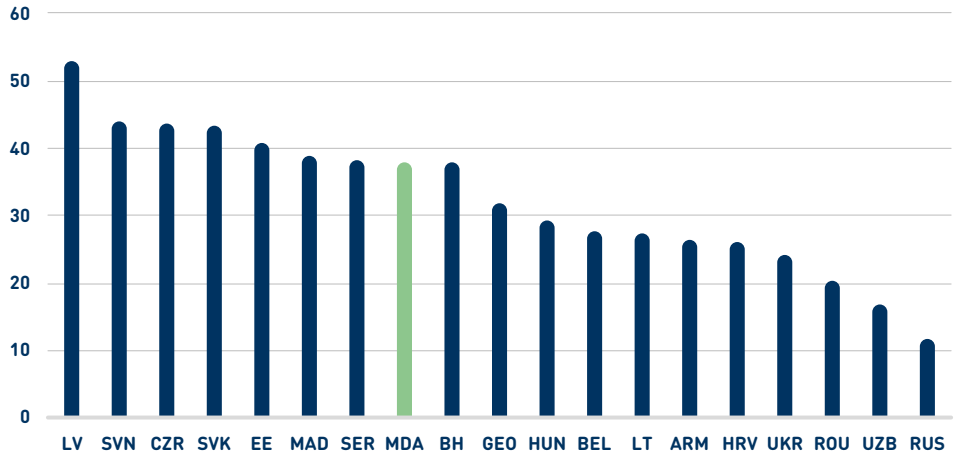
The peer review panel of independent experts also emphasized the importance of adequate funding for the proposed reforms to work in practice and urged adequate government support to build Moldova's R&I capacity, the swift implementation of long-awaited national reforms to the structure, governance and functioning of the R&I system as well as carefully nurturing the human resource base.

Source: The UNECE, based on (European Commission , 2016).[a]
[a] European Commission (2016), *Peer Review of the Moldovan research and innovation system*, Luxembourg: European Union.

The problem is especially pronounced in the ICT sector. Having grown exponentially in the past two decades, to the point where it made up 14 per cent of service exports in 2017, the ICT sector is looking to move up its value chain. This would require access to and the availability of the right skills in Moldova to accompany such a transition. The ICT sector has already highlighted the gap in science, technology, engineering and math (STEM) graduates for IT professions with around 700 students graduating each year and roughly 1000 ICT or ICT-related companies in Moldova seeking to employ them. This understandably leaves many of these innovative firms understaffed and forces them to turn to graduates from Belarus and Ukraine to meet their high-skilled employee needs[12].

The issue of the skills mismatch is partly addressed by companies offering formal training to their employees (Figure 2.7). As explored further in Chapter 4 and confirmed by the fact-finding undertaken for this review, firms in Moldova consider skills related to the use of existing technologies as a crucial component of their competitiveness. Therefore, they readily invest in the training of young graduates and enhancing of skills of more experienced employees, but Government action is also needed to complement these efforts.

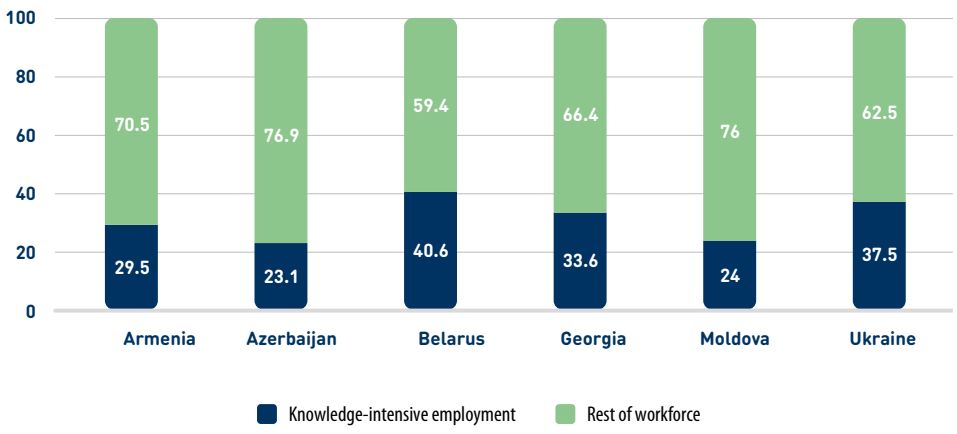
Figure 2.7 · Share of firms offering training, 2019
(Percentage of all surveyed firms)



Source: The UNECE based on the World Bank TCdata360.

As previously mentioned, available data reveals there is a shortage of local workers to fill highly-skilled jobs in Moldova, this is an issue that is being compounded by the high emigration rates among young Moldovans who could help address this shortage. This is a matter of some urgency and requires policy action to prevent further erosion of the pool of high-skilled workers and those working in the knowledge-intensive sectors (24 per cent of the workforce in Modova, relatively lower than in the comparable economies) (see Figure 2.8). Capitalizing on the potential of high-skilled Moldovans living abroad to address labour shortages at home could be an effective policy direction as the excellent human capital of the Moldovan diaspora has great potential to fuel innovative and sustainable development across the country (see Chapter 6 for more details).

Figure 2.8 · Knowledge-intensive jobs, as a percentage of the workforce, 2020 (Per cent)



Source: The UNECE based on the Global Innovation Index 2021.

In addition, female participation in the workforce remains a concern, as women represent 52 per cent of the population and account for 33.9 per cent of entrepreneurs in Moldova[13]. Despite female enrolment rates in tertiary education ever-increasingly outpacing their male counterpart for the past 20 years, this phenomenon has failed to feed through to labour market outcomes where there has been a decline in female labour force participation rates and a slight widening of gender disparities in earnings.

Policy messages

Although Moldova has substantial potential to benefit from innovation in many areas of socioeconomic activity, several constraints are preventing new ideas, products and processes from being embraced throughout the economy and acting as key drivers of sustainable domestic development in the decades ahead. These constraints are varied, be it the lack of firm capacity to absorb new ideas or the scarcity of R&D funding, but each one contributes to Moldova missing opportunities to grow and develop in line with national goals and priorities. Forging and incentivizing more and better linkages between science and business should be at the core of not only research policy but also private sector development policy. These changes need to happen in partnership with efforts to address the skills gap by aligning investment into education more closely with the needs of the private sector so it can act on the opportunities it has identified.

The chapters that follow will take a closer look at the country's innovation governance (Chapter 3), ways to strengthen its science-industry linkages, boost technology commercialization (Chapter 4) as well as examine how to improve innovation and technology transfer infrastructure (Chapter 5). The final chapter is dedicated to exploring the role and potential of the Moldovan diaspora in promoting innovation for sustainable development throughout the country (Chapter 6).

Table 2.1 Overview of main strengths and challenges for innovation-driven development

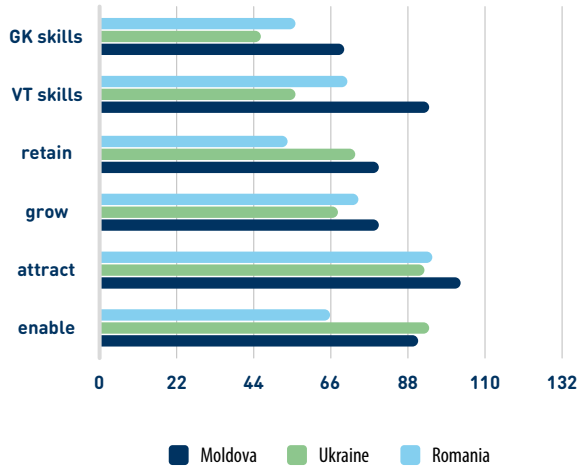
Strengths and opportunities	Next development milestones
• A relatively favourable business environment that is well-suited to allowing innovation. • Opportunities for knowledge and innovation transfers through trade and investment flows (e.g. ICT, the automotive sector). • A usable base of existing R&D organizations already engaged in innovation activities in the private sector, proximity to the EU and access to other important markets. • High tertiary education attainment rates, relatively good quality of education (e.g. STEM).	• Ensure favourable conditions for systematic experimentation with new ideas through improvements in soft and hard infrastructure as well as by an overall strengthening of the national innovation system. • Enhance the absorptive capacities of firms to effectively adapt and adopt new knowledge and technologies for innovative development. • Encourage linkages and put in place the right incentives to promote cooperation between the private and R&D sectors. • Address the skills mismatch to effectively meet private-sector needs to increase its rate of innovative development. • Engage the Moldovan diaspora more systematically to bring harness additional skills, contacts, opportunities and capital to help fuel innovative initiatives.

Source: The UNECE, analysis by the author.

Table 2.2 Innovation Performance Overview of Moldova

Global Talent Competitiveness Index, 2020[a]

(Ranking, Moldova and comparator economies among 132 countries, 132 – the lowest)

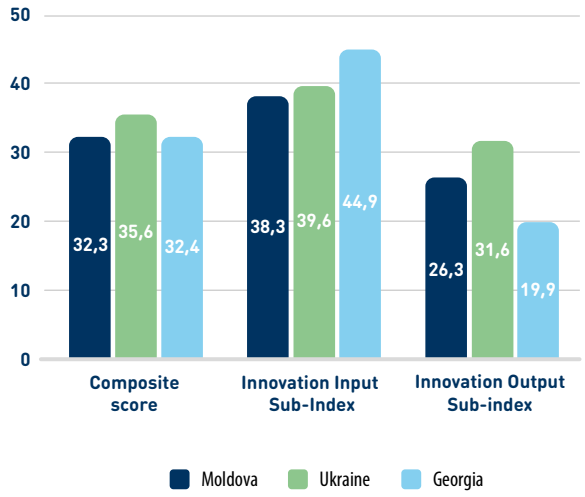


World Bank Doing Business, 2020

Indicator	Score[b]	Rank
Starting a business	95.7	13
Dealing with construction permits	56.2	156
Getting electricity	75.3	84
Registering property	82.8	22
Getting Credit	70	48
Protecting minority investors	68	45
Paying taxes	85.2	33
Trading across borders	92.3	38
Enforcing contracts	63.6	62
Resolving insolvency	54.8	67
Overall score	74.4	48

Global Innovation Index (GII), 2021

(Scores[c] , Moldova and comparator economies)



Innovation in the private sector

Patent applications, 2020 (number, total)	246
Technological adoption (1-7, the best)	4.1
ICT use (1-7, the best)	5.1
Infrastructure (1-7, the best)	3.7
Business sophistication (rank, GII)	88

R&D and education

Quality of scientific research institutions (1-7, the best)	2.9
Efficient use of talent (1-7, the best)	3.8
Quality of education (1-7, the best)	3.8
Government expenditure on education as a percentage of GDP)	5.4
QS university ranking, average score top 3* (rank, GII)	77

Source: The Global Competitiveness Index, 2018[d] ; Global Innovation Index, 2020[e]; World Bank Doing Business, 2019[f]; World Development Indicators, 2020[g]; Moldovan National Agency of Intellectual Property (AGEPI), 2020[h].

[a] https://www.insead.edu/sites/default/files/assets/dept/globalindices/docs/GTCI-2020-report.pdf

[b] Scores reflects the distance to frontier, where 0 represents the lowest and 100 represents the best performance.

[c] Scores are from 0-100, where 0 presents the lowest and 100 presents the best performance.

[d] http://reports.weforum.org/global-competitiveness-index-2017-2018/countryeconomy-profiles/#economy=MDA

[e] https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020/md.pdf

[f] https://www.doingbusiness.org/en/reports/global-reports/doing-business-2020

[g] https://databank.worldbank.org/source/education-statistics-%5E-all-indicators

[h] https://www.insead.edu/sites/default/files/assets/dept/globalindices/docs/GTCI-2020-report.pdf

Notes

1 According to the Global Innovation Index methodology, innovation inputs include instutions, human capital and research, infrastructure, market sophistication, and business sophistication.

2 See the findings of the UNECE (2020), *Sub-regional Innovation Policy Outlook: Eastern Europe and the South Caucasus*. Available at https://unece.org/innovation-policy-outlook

3 Armenia ranks 47th and Belarus 49th according to the World Bank Doing Business Report 2020.

4 NBS Informative Note Nr. 05-3-09/14, December 2019

5 3326 enterprises were interviewed.

6 According to the 2019 EBRD BEEPS V Survey, almost 37 per cent of firms reported having introduced new products or services and 15 per cent new processes, with small and medium enterprises (SMEs) accounting for the largest share in the first case and the large enterprises in the second.

7 While acquisition of such capital is a commendable approach to ensure firms' competitiveness, these investments, generally, fall short of facilitating broad experimentation and the generation of positive spillovers for the economy and society that are generated by innovation.

8 Word Bank (2019), Moldova: Rekindling Economic Dynamism

9 ISO 9000 is a set of international standards on quality management and quality assurance developed to help companies effectively document the quality system elements needed to maintain an efficient quality system. They are not specific to any one industry and can be applied to organizations of any size.

10 Horizon 2020 Policy Support Facility (2016), *Peer Review of the Moldovan Research and Innovation system* available at https://rio.jrc.ec.europa.eu/library/horizon-2020-policy-support-facility-peer-review-moldovan-research-and-innovation-system

11 EBRD (European Bank for Reconstruction and Development) (2019). Business Environment and Enterprise Performance Survey (BEEPS V),Country profile, Moldova, available at: https://www.enterprisesurveys.org/content/dam/enterprisesurveys/documents/country/Moldova-2019.pdf

12 Based on an interview with a CodeFactory representative (ICT company, Chisinau) as part of the fact finding process undertaken for this review.

13 Statistica Moldovei, UN Women (2020). Raport analitic privind participarea femeilor și bărbaților în activitatea de antreprenoriat, p. 31. Available at: https://statistica.gov.md/public/files/publicatii_electronice/Antreprenoriat_feminin/Antreprenoriat_Femei_Barbati_2020.pdf

Chapter 3

ENHANCING THE NATIONAL INNOVATION SYSTEM AND ITS GOVERNANCE

Main messages

- The Moldovan Government has expressed a clear political commitment to supporting innovation, a position that is reflected in its efforts to establish different innovation support mechanisms. At the same time, the national innovation system remains nascent and in need of further nurturing, especially in the areas of financing and facilitating local innovation initiatives.
- Innovation governance in Moldova is still evolving and is currently somewhat underdeveloped and not as streamlined as it could be. While key legislative and institutional building blocks are in place, policy efforts are fragmented across a number of ministries and agencies that lack systematic synergies. Furthermore, all levels of government and the institutions that play a role in innovation lack the capacities to effectively design, implement and monitor innovation policies that include and systematically engage with all the relevant stakeholders.
- The above-mentioned issues are likely to persist as innovation policy lacks a strategic cross-government coordination mechanism able to guide and align innovation policy efforts towards effective innovation promotion and support at both the national and sub-national levels.
- Public-private dialogue to help formulate inclusive and relevant policies is not yet systematic but could be readily strengthened by building on the existing stakeholder-engagement mechanisms which includes civil society organizations, academia and private sector representatives.
- Innovation activity in the public sector has been limited to efforts on the digitalization of government services and processes. As such, substantial scope for further improvement and reforms remain in connection with eGovernment and efforts to drive the demand for innovation through public procurement (i.e. innovation-enhancing procurement).

Recommendations at a glance: Enhancing innovation policy governance

Recommendation 3.1: Reform and complement the institutional and legislative framework for innovation policy based on a broad definition of innovation and the imperative to build and nurture effective innovation systems.

Actions	Priority	Time-frame	Roles
3.1.1. Adopt a holistic approach to innovation policy governance.	①	Medium-term	Ministry of Economy (MoE) as well as the Ministry of Education and Research (MER)
3.1.2. Enhance the legal framework for financing innovation.	②	Short-term	The MER and MoE
3.1.3. Ensure that the legislative, institutional and public finance frameworks enable innovation policy initiatives at the sub-national level.	③	Medium-term	The MER and Ministry of Infrastructure and Regional Development (MIRD)

Recommendation 3.2: Strengthen processes and institutional capacities throughout the policy cycle, in particular, regarding stakeholder dialogue and effective policy monitoring and evaluation.

Actions	Priority	Time-frame	Roles
3.2.1. Strengthen public-private dialogue to ensure systematic and constructive engagement of non-government stakeholders affected by innovation policy.	②	Medium-term	The MIRD, MER, MoE and National Agency for Research and Development (NARD), other relevant ministries and agencies
3.2.2. Make better use of online platforms for public consultations to ensure more systematic engagement of stakeholders in formulating innovation policy.	③	Long-term	The MER and all the Government
3.2.3. Improve the monitoring of policy implementation through increased public administration capacity and external evaluations.	①	Short-term	The MER, NARD and all the Government

Recommendation 3.3: Enhance policy coordination and alignment across all levels of government to improve the targeting and effectiveness of policy actions.

Actions	Priority	Time-frame	Roles
3.3.1. Establish a National Innovation Council to coordinate and strategically guide innovation policy formulation and implementation.	①	Short-term	The Government (an initiative by MER)
3.3.2. Ensure, under the oversight and guidance of the National Innovation Council, that innovation policy aligns with other sectoral policies.	②	Medium-term	The MER and all the Government
3.3.3. Systematically engage sub-national authorities (i.e. at the district, municipal and autonomous-territory levels) in innovation policy processes.	③	Long-term	The MER, MIRD and MoE

/...

Recommendation 3.4: Accelerate innovation processes in the public sector through further eGovernment reforms and strengthen the demand for innovation via the introduction of an innovation-enhancing procurement framework.

Actions	Priority	Time-frame	Roles
3.4.1. Establish a clear framework for innovation-enhancing procurement.	②	Long-term	The MoE and Public Procurement Agency
3.4.2. To accompany the ongoing e-Government reform, mandate training for public servants to enhance their digital literacy proficiency and expand other related skills.	①	Medium-term	The Academy of Public Administration and MER

Source: The UNECE.

The Moldovan Government has shown a strong policy commitment to support innovation, reflected by the existence of an array of mechanisms to support the nascent national innovation system

Moldova has put innovation high on its policy agenda – but innovation remains far below potential.

In recent decades, the Government of Moldova has increasingly recognized the role of innovation as a key driver of a competitive and sustainable economy. This has resulted in the implementation of digitalization reforms of public administrations and services as well as widespread efforts to strengthen different aspects of the national innovation system. Salient among these is a clear shift towards stronger competition for state funds to support innovation and research[1] under the direction of the new National Agency on Research and Development. Furthermore, there have been a range of other targeted initiatives to strengthen the country's innovation infrastructure, most notably to nurture science and technology parks, incubators and clusters.

Nevertheless, and as noted in Chapter 2, innovation in Moldova, remains far below potential. Systemic innovation requires the systematic engagement of all the involved stakeholders who cooperate and learn from each other. This review is, for that reason, based on the concept of a national innovation system (see Box 3.1). Enabling, building and nurturing such a system is particularly important for innovation in relatively small, open and transitioning economies such as Moldova's.

Box 3.1 What is a national innovation system

A national innovation system (NIS) is the term used to label the framework of the various elements and dynamics that underpin the process of experimenting with ideas at the national level. The system can vary from country to country but is usually made up of several key sub-systems at work within a given economy, namely:

- the (national and international) markets for innovative products and services;
- firms and entrepreneurs (national and international);
- knowledge generation activities, such as universities, public research organizations (PROs) as well as research and development (R&D) institutions;
- innovation intermediaries providing support services; and
- the framework conditions that shape the incentives for and constraints to innovation.
- Vibrant linkages among all the actors of the national innovation system are essential for this system`s effectiveness in generating and experimenting with new ideas. It is the complex interactions and linkages between the different actors within the national innovation system that influence the generation and diffusion of innovation in the economy and the efficiency of the innovation process (i.e. how rapidly an innovation goes from being an idea to the market in the form of a new product, service or process).

Source: The UNECE.

As this chapter will go on to detail, the Moldovan national innovation system is nascent and not yet able to sustain the systematic experimentation with new ideas that is needed to more fully harness the nation's potential for innovation that was noted in Chapters 1 and 2. A central concern is the weak linkages among businesses, research organizations, foreign companies, investors and markets due, in part, to the low absorptive capacity of Moldovan firms (see Chapter 2) and lack of incentives for actors to innovate (discussed in detail in Chapter 4). A related issue is ensuring the better diffusion of innovation, including that which comes from abroad, throughout the economy's various sectors in both developed urban and more developmentally-challenged rural areas, a topic that is discussed in detail in Chapter 5. Engaging the skills, networks, demands and capital of the large diaspora presents an important opportunity that should be exploited systematically, as showcased in Chapter 6.

The next sections of this chapter present an analysis of Moldova's innovation governance, including legislative and institutional frameworks for innovation policy, as well as an assessment of current policy coordination mechanisms. It will also feature the main strengths and weaknesses in this area while providing tailored recommendations to resolve the identified challenges. The recommendations made in this review focus on measures likely to have the most positive impact on innovation performance in both the short- and long-term, given the existing financial and human resource constraints in Moldova.

With the key building blocks already in place, innovation governance in Moldova now needs strategic direction and coordination based on a holistic view of innovation

A holistic approach to innovation governance is essential to fully harness the existing innovation potential.

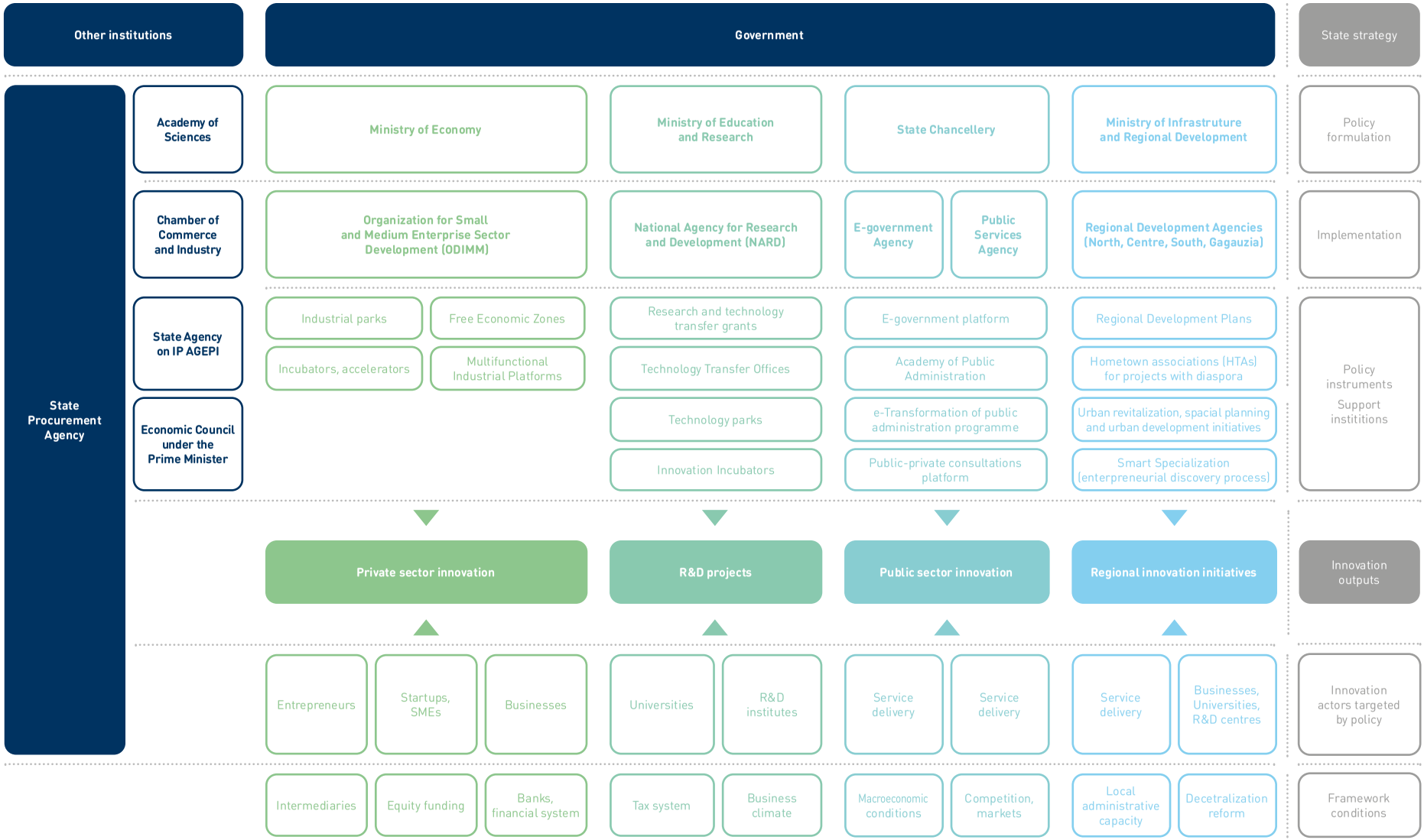
Innovation governance refers to the rules, institutions and processes that determine the role of the public sector in enabling and promoting innovation and nurturing the national innovation system. The purpose of this innovation governance framework is to design, implement and then evaluate the policies and measures put in place to promote innovation. This allows the Government to monitor how the relevant decision-making rules affect innovation processes and what impact it has on the interactions among innovation stakeholders. Given the complex nature of the national innovation system, relevant policy areas go beyond that of public research and digitalization. This highlights one of the largest and most immediate challenges to effective innovation governance, namely, putting in place efficient mechanisms to coordinate and harmonize policies in a diverse range of areas so they are targeted, cost-effective, synergistic and additive.

Innovation policy is focused on research and development with very weak links to supporting innovation in the private sector.

The lack of such coordination mechanisms and broad policy coherence in Moldova stands out. The Figure 3.1 presents the main institutions and strategies involved in innovation governance in Moldova. The MER is responsible for developing and overseeing the National Programme on Research and Innovation (NPRI) 2020-2023, setting objectives, defining roles and allocating responsibilities for innovation policy. Under the MER, the NARD oversees state funding of R&D&I projects while the National Agency for Quality Assurance in Education and Research is tasked with evaluating the national science, research and innovation institutions.

Most public support for private-sector development, however, is outside of this remit – with no joint policies or coordinating bodies. Apart from initiatives such as smart specialization and the nascent Working Group for the organization and development

Figure 3.1 · Innovation Governance in Moldova



Source: The UNECE, based on author's analysis.

of the Entrepreneurial Discovery Process, set up in 2019, SME and private-sector development generally fall under the Government Action Plan 2020-2023. Under this structure, the MoE, Organization for Small and Medium-sized Enterprise Development (ODIMM), MIRD and the Ministry of Agriculture and Food Industry (MAFI) are the responsible institutions, each playing a particular role in their respective areas. Given the importance of the private sector in the innovation system, especially the potential held by innovative high-growth enterprises (IHGEs), the lack of clear links to the entities which jointly oversee private-sector innovation inevitably hinders innovation governance.

The central role of innovation in sustainable development needs to be reflected in key policies and strategies

As outlined in Chapters 1 and 2, innovation is central to sustainable development and the goal to improve the quality of life of Moldovan citizens, as outlined in the National Strategy for Sustainable Development – Moldova 2030. This importance of innovation, however, is yet to be reflected in leading strategic policy documents as Moldova 2030 has not been adopted by the Parliament and a new national development strategy is under discussions.

As such, while there have been signs of a high level of commitment and a willingness to act, this has not been fully translated into concrete action to provide attention to and investment in innovation. The Voluntary National Review (VNR) of Moldova 2020, noting declining R&D expenditure and emigration of skilled labour, including researchers, concluded that "the reduced use of innovation and research in solving societal problems limits the competitiveness and the capacity of the state to respond to the multiple problems influencing negatively the sustainable development"[2].

While innovation features prominently in several areas, a comprehensive strategic vision in policy documents is lacking

As noted above, strategies that are central to innovation, such as Moldova 2030, do not provide a comprehensive vision of the role of innovation in Moldovan socioeconomic life. Nevertheless, innovation already features prominently in a range of areas, however, the lack of efficient coordination at the national level sustains the fragmented nature of innovation governance and hampers the ability of the Government to take a productive, catalytic and, especially given the currently challenging fiscal environment, cost-effective role in nurturing the national innovation system[3].

In this regard the Strategy for Inclusive, Sustainable and Digital Economy until 2030[4] is set to replace the Moldova 2030 Strategy and is framed using a similar range of areas, including innovation. The Government Action Plan for the period of 2020-2023[5] is the overarching document guiding policy efforts, including on innovation under Pillar VII[6] and, to a lesser degree, under Pillar IV which targets enterprise competitivenes[7]. Innovation also features among sectoral strategies, such as the Strategy on Development of the Information Technology Industry and Digital Innovation Ecosystem for 2018-2023.

Innovation policy is often perceived as restricted to research policy – leaving substantial potential untapped

The NPRI 2020-2023, despite being viewed as the overall guiding document for innovation policy, focuses *de facto* on research and development, most of which is government-funded. It aims to broadly align the objectives and strategic priorities

in research and innovation with the EU practices, norms and regulations (e.g. the European Research Area framework[8]). This includes, *inter alia*, efforts on smart specialization (Box 3.2) and makes clear links to sustainable development goals (SDGs) through ambitions in sectors such as health care and social safety. While commendable, this approach fails to include private-sector capabilities, which are crucial drivers (see Chapter 2) to not only research (as discussed in Chapter 4) but in virtually all areas of innovation. In a similar vein, the NPRI does not clearly align with education policy, which is especially important given the lack of appropriate skills for innovative development (Chapter 2). Although a notable positive here in terms of alignment are the measures to increase the share of young researchers and strengthen the overall quality of the R&D sector. The NPRI needs to better integrate the MoE and especially ODIMM, the two key entities that are tasked with private-sector development, for the policy to achieve the intended positive impact on the national innovation system.

Innovation policy documents should include building private sector capabilities to absorb innovation as one of key drivers of innovative development.

Moldovan policy documents at both the national and sectoral levels generally adopt an overly narrow approach to innovation. This approach is typified in the policy to support the Moldovan ICT sector, run by the Ministry of the Economy (MoE) through a dedicated programme that operates autonomously from the NPRI. While the importance of investing in research cannot be overstated, the Information and Communication Technologies (ICT) sector and technology start-ups are the most obvious alternate targets for investment in innovation. However, the lack of a comprehensive strategic vision that could lead to concrete policy actions means that policies and instruments to date have overlooked much of the innovation potential that exists elsewhere. This includes sectors that, at first glance are not readily associated with innovation, such as social services, construction, agriculture and light manufacturing. In this regard, Chapter 1 noted that the potential for gradual productivity improvements and diversification through the absorption and adaptation of existing ideas and technologies in such sectors could yield substantial and widespread socioeconomic benefits. Strikingly, these sectors are where more than half of the IHGEs in advanced economies can be found (e.g. the construction sector in the US has the second-largest sector-based grouping of IHGEs in the US economy[9]).

Innovation potential resides across the economy, going beyond ICT.

Given the above-mentioned issues, for the national innovation system to become an effective and nurturing environment, Moldovan policy needs to adopt a more holistic approach to unify the various concentric circles of relevant policy areas and institutions *(Recommendation 3.1.1)*.

Box 3.2 The smart specialization approach to fostering subnational innovation systems

Smart specialization (S3) is a framework to build and nurture local and regional points of competitive advantage through partnerships and bottom-up initiatives. Adopted by the European Commission in 2010 to reduce disparities and ensure balanced economic development across Europe, S3 puts the entrepreneurial discovery process front and centre, with broad dialogue working to identify new ideas that have strong potential based on existing strengths and opportunities. Smart specialization introduces and complements approaches such as clustering.

Source: The UNECE, based on https://s3platform.jrc.ec.europa.eu/s3concept.

The key legislative and institutional building blocks of innovation governance are in place but lack systematic synergies and institutional capacities to deliver effective policies

Despite reform momentum, gaps and inconsistencies among laws and regulations remain, especially in the areas of innovation financing and regional development

Enhancing the legal framework for financing innovation will require legislation on venture capital and transparent mechanisms to attract and use FDI.

The National Roadmap for Integration of the Republic of Moldova into the European Research Area (ERA) for 2019-2021[10] aims to harmonize Moldovan regulations and standards with those of the EU for, *inter alia*, efficient publicly-funded research investment, international linkages, competition and gender equality. This has led to a range of legislative modifications, such as the 2018 update of the Code of science and innovation (no. 259-XV dated 15 July 2004)[11], which improved competition in the selection and financing of research, updated and detailed institutional responsibilities and clarified the rules for intellectual property protection and international cooperation. Another legislative modification was the Methodology for Financing of Projects in the Area of Research and Innovation (no.382 dated 1 August 2019)[12] which improved competition for public funding offered through the NARD. Finally, the Law on Science and Technology Parks (STPs) and Innovation Incubators (IIs) (no. 226 dated 1 November 2018)[13] provides a framework for new types of innovation infrastructure.

Building a system for financing innovation, especially through equity participation mechanisms, is an important yet underdeveloped piece of the innovation system. With no legislation setting transparent and efficient frameworks for high-risk innovation financing, i.e. equity and venture capital funding, no clear regulatory mechanisms in place to effectively attract and use foreign direct investments (FDI) in the R&D-intensive and innovation-oriented activities in the country, innovation is being hampered in both the public and private sectors *(Recommendation 3.1.2)*.

Enabling innovation activity at the local level should be an important policy direction as no regional science and innovation policy exist in Moldova[14]. This requires, inter alia, that national legislative frameworks enable the development and implementation of innovation policy initiatives by sub-national governments to facilitate and promote innovation in line with national policy objectives *(Recommendation 3.1.3)*. Ongoing decentralization reform efforts could make a significant contribution in this regard if local governments are allocated sufficient financial and decision-making capacities to support policy initiatives and realization (Box 3.3).

Various mechanisms are in place but stakeholder engagement is not always systematic

Public-private dialogue to ensure inclusive and relevant policies is not yet systematic and could be strengthened.

The complexity of the innovation system and the need to move towards an enabling and nurturing role for the Government, rather than one involving detailed planning and priorities, increases the need for systematic and effective stakeholder engagement in policy processes. This could be done through public-private dialogue which serves to identify opportunities and constraints as they emerge. At the same time, it is important to ensure that such stakeholder engagement does not become a vehicle for the protection of entrenched interests – as innovation, by definition, is about new activities and should enjoy a level playing field to thrive.

Box 3.3 Innovation at the local level – a bottom-up regional development perspective for Moldova

Bottom-up innovation in the context of regional development suggests that ideas are generated and nurtured at the local level and have the potential to be scaled-up for diffusion across regions and sectors or even placed on the national or international stage. Innovative ideas normally have a local source but their successful implementation depends on both national and sub-national innovation policy frameworks and the capabilities of the relevant authorities to foster innovative activity in their city, municipality or region. Similar to the private sector, where corporate culture can act as either an "idea generator" or an "idea killer", framework conditions at both the national and local levels are essential for innovation. The capacity of local governments to foster innovation through local initiatives, as well as appropriate support at the national level to scale-up these ideas, are both essential. There is also an important role for national institutions to engage at the subnational level (in collaboration with the regional and local authorities), especially to kickstart innovative development in economically weaker regions that may lack the needed capacity to develop innovation policy.

Decentralization reforms are important to enable such dynamics. Despite progress since 2012 towards the grouping of administrative units to enhance governance, first-tier government units in Moldova remain fragmented (898 villages, communities, towns and municipalities), posing challenges for individual initiatives. The limited financial and administrative autonomy of local governments, along with the misalignment between the legal competences and resources allocated to them to perform their assigned functions, restrict their ability to act as innovation enablers. Approximately 90 per cent of local government income is derived from central government subsidies earmarked for education, healthcare and social protection[a, b]. With limited flexibility to use central government transfers, their underdeveloped local income base leaves local governments minimal funding to promote innovation and hire qualified staff, leaving them poorly equipped to address local needs and challenges, including those of innovative ventures.

Challenges in empowering local governments to perform more effectively are also impacted by the uneven distribution of enterprise and innovation activity in Moldova. Currently, most businesses and innovation institutions (both private and public) are concentrated in Chisinau. While the lack of adequate infrastructure and networks combined with fewer opportunities in other municipalities are among the reasons for this, the scope of action of local governments also play a role. Innovation could be key to unlocking local potential with successful innovative ventures able to increase the local tax base, scale-up existing 'pockets of excellence' and enable and find innovative solutions to local development challenges.

Thus, progress on decentralization could have a positive impact on the development of local and national innovation systems for increased competitiveness. Capable and well-resourced local government could better respond to local economic and social challenges[c], contribute to the regional development efforts of MIRD and promote broad-based experimentation at the sub-national level. With fragmented efforts on smart specialization at the local level coupled with multiple projects on energy efficiency, water and waste management as well as urban planning, there is scope for innovation to take a central role in regional development efforts.

Source: The UNECE based on Alexandra Schantl, 2021[d].

[a] Alexandra Schantl, N. H. (2021). *Decentralisation and local public administration reform in Georgia, Moldova and Ukraine*. Skopje, North Macedonia: NALAS in cooperation with PLATFORMA and the technical assistance of KDZ.

[b] Those represent own revenues perceived through the mechanism of sharing of the personal income tax and the real estate tax and the land tax, which are limited by caps and ceilings imposed by the national government.

[c] https://rm.coe.int/local-and-regional-democracy-in-the-republic-of-moldova-monitoring-com/1680939183

[d] Alexandra Schantl, N. H. (2021). *Decentralisation and local public administration reform in Georgia, Moldova and Ukraine*. Skopje, North Macedonia: NALAS in cooperation with PLATFORMA and the technical assistance of KDZ.

Public-private dialogue to ensure inclusive and relevant policies is not yet systematic and could be strengthened.

Moldova has in place several public-private consultation mechanisms (e.g. dedicated platforms, events organized by the Government) for this purpose. The most prominent of these is the 118 member Economic Council under the Prime Minister which serves as an advisory platform for dialogue among business associations, donors and policymakers to improve the entrepreneurship and investment environment[15]. However, innovation does not regularly feature in council discussions despite its importance. Integrating the council firmly within a comprehensive framework for innovation governance is, as a result, essential *(Recommendation 3.2.1)*.

The work carried out by USAID to support business associations, centres of excellence and similar institutions in building their organizational capacity, financial sustainability and advocacy effectiveness[16] is also an important element of Moldova's effective public-private dialogue regarding innovation. USAID also funded an online platform for public-private consultations – www.particip.gov.md to enhance stakeholder engagement and ensure

the principle of "participatory democracy" along with continuous dialogue between the Government and its citizens. Although major public bodies are registered and are relatively active on the platform, the quantity of feedback received from the public is generally rather limited. For example, the MER Research has published 720 draft policy documents and initiatives on the platform since 2012 which received only 613 comments ; indeed, most drafts received feedback before they were removed[17]. The Government could make better use of this platform for innovation policy purposes, engaging in active promotion of the platform`s functionality as a public consultation means during events with non-government organization (NGO) participation and through awareness-raising campaigns (e.g. Chamber of Commerce and Industry events, events organized by the public agencies, etc.) to ensure it becomes an effective communication channel with innovation system stakeholders *(Recommendation 3.2.2)*.

Improving and mainstreaming systematic monitoring and evaluation is essential to improve policy efficiency and coherence

Evaluation of innovation policy mostly concerns the evaluation of R&D activities with the National Agency for Quality Assurance in Education and Research in the lead.

Since innovation policy is currently dominated by R&D, policy evaluations focus on the R&D activity rather than the innovation activity, broadly defined. Under this regime, the National Agency for Quality Assurance in Education and Research (the Agency) is the main government body responsible for evaluating the capacity of research and innovation organizations. Established in 2018[18], it is subordinated to the MER and is tasked with ensuring the quality of services provided by institutions in the field of education and research. Charged with quality assurance at all levels of education, the Agency also carries out evaluations of various ongoing professional training programmes, scientific and teaching staff and has recently begun evaluating research and innovation-focused organizations.

The Agency is a member of several notable quality assurance organizations in the area of education[19] that evaluate higher educational programmes and institutions in line with the relevant frameworks developed under the auspices of the ENQA and EU[20]. Since the start of its operations, the Agency has been conducting the first round of its evaluation process which has now been completed for around 95 per cent of Moldova's existing education programmes. The Agency is also charged with granting institutional accreditations to educational establishments, however, no accreditations have been issued as the associated costs are considered to be too high[21].

The evaluation of organizations in the field of R&I will be carried out according to the newly-developed methodology.

The decision to start evaluating organizations in the field of R&I is recent and has not been yet undertaken as a dedicated methodology developed by the Agency is under consideration by the Government. The draft document outlines the processes and criteria to be used when evaluating PROs, which starts with a self-evaluation report by the R&I organization and concludes with an analysis of the Agency's report regarding the attribution of the relevant qualification to the organization. The awarded qualification would play role in applications for state funding for R&I provided by NARD and carry potential benefits for participation in international R&I projects. In a similar vein, the decision has also to be taken on the possible accreditation of private sector entities for the participation in state R&D funding disbursed by NARD. In such cases, eligibility for state funding will be based on appropriate criteria for the selection of projects from businesses.

Monitoring policy implementation in Moldova involves the implementing agencies reporting on progress achieved regarding their assigned actions, this report is passed on

to the state body responsible for the agency in question and this state body then passes the information to the State Chancellery. The State Chancellery is therefore ultimately responsible for monitoring policy implementation and is tasked with arranging for external evaluations of the implementation of strategic Government policy.

Innovation policy monitoring is not carried out in a systematic and structured fashion with scope for policy learning and increased capacity for implementation.

In the case of sectoral strategies and programmatic documents, such as the National Programme on Research and Innovation 2020-2023, the implementing institutions report to the MER which then submits the annual report to the State Chancellery before it I presented to the Government. While monitoring policy implementation is adequately structured and routinely undertaken, the quality of progress reports and monitoring practices could be enhanced by ensuring the involved public administrations can provide timely and quality reports (e.g. through training, allocation of sufficient human resources) and providing the ability to disengage from initiatives and processes that are ineffective *(Recommendation 3.2.3)*.

Evaluations of state programmes by an external evaluator are rarely undertaken because of the high costs associated with such evaluations as well as limited institutional capabilities to react to recommendations to enhance policy effectiveness, such as making organizational changes or altering implementation processes. However, this is an important process step going forward as it allows the Government to identify gaps and the real effects of policy actions, providing the opportunity to adjust strategic policy planning and delivery while minimizing resource wastage.

A well-resourced National Innovation Council with a broad mandate could improve policy coordination

Horizontal policy coordination should be strengthened.

A National Innovation Council could be a significant step forward to both increase the effectiveness of innovation policy implementation and strategically guide policy efforts across all economic sectors and levels of government. The council could play a crucial role in bringing in a common understanding and strategic vision to all the relevant actors of innovation as a driver of the nation's economic growth and sustainable development *(Recommendation 3.3.1)* (Box 3.4).

Vertical coordination of innovation policy should complement horizontal policy efforts.

Coordination among national and sub-national levels of government is also essential for innovative development as it helps to maximize the positive effect of local initiatives to benefit the whole country. With several local initiatives, such as smart specialization (Box 3.2) and StartUp City Cahul (Box 3.5), greater coordination is needed to ensure additionality and maximum efficiency of these activities.

At the national level, as new development strategies and sectoral-programme documents are developed[22], it is important to ensure the alignment of their strategic objectives and main goals with innovation policy documents. The National Innovation Council, if set up, could be instrumental in this regard to ensure synergies, avoid policy duplication and inefficient use of public resources while strategically promoting innovation across all sectors of the economy *(Recommendation 3.3.2)*.

At the subnational level, Moldova can assist local governments in supporting innovation through better coordination of innovation policy and local initiatives (to scale-up what works and exchange experiences across regions), which should entail the systematic engagement of the subnational authorities in decision-making processes at the national level, e.g., through the National Innovation Council if one had been established *(Recommendation 3.3.3)*.

Box 3.4 A National Innovation Council is an instrument to provide effective leadership and coordination of innovation policy

A National Innovation Council, or a ministerial body tasked with developing and putting into practice a holistic perspective on innovation across policy areas, is a widely used tool to tackle the issue of fragmented innovation policy governance that is a natural consequence of the cross-cutting nature of innovation. Such a body helps to remove barriers to spontaneous, bottom-up collaboration among innovative actors[a]. An Innovation Council coordinates, aligns and ensures synergies among various stakeholders engaged in innovation policy design and implementation, facilitates action across all policy domains and levels of government, enables systematic engagement of stakeholders and promotes the dynamism and agility needed to respond to emerging challenges and opportunities[b].

Such councils are often anchored at the ministerial level, chaired by the Prime Minister, and supported by a strong secretariat. This provides innovation policy issues with a much higher profile and keeps them as important agenda items both within the Government and within government agencies, i.e. in the entire state apparatus[c]. The scope of issues covered by the National Innovation Council will be determined by the widely accepted definition and strategic vision of innovation to drive socioeconomic development. Councils targeting innovation outcomes and considering science and research as components of innovation has proven to be a viable approach to unlock the benefits of innovation for the economy and society as a whole, going beyond scientific and research considerations alone.

Determining the best diversity of council membership is essential: too broad a membership can inhibit effective decision making, while too narrow participation could reduce inclusiveness. International experience in this regard, such as the Swedish Innovation Council, the Swiss Science and Innovation Council as well as the Georgian Research and Innovation Council, offers good comparative examples to help find the right balance adapted to the national context and innovation governance challenges.

Source: The UNECE, based on Edquist, 2016[d], and Vinnova, 2015[e].

[a] UNECE. (2021). *Sub-regional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus*. Geneva: United Nations Publication.
[b] Vinnova. (2015). *National Research and Innovation Councils as an Instrument of Innovation Governance*. Stockholm: VINNOVA - Swedish Governmental Agency for Innovation Systems.
[c] Edquist, C. (2016). *The Swedish National Innovation Council: Innovation policy governance to replace linearity with holism*. Lund: CIRCLE.
[d] *Ibid*
[e] Vinnova. (2015). *National Research and Innovation Councils as an Instrument of Innovation Governance*. Stockholm: VINNOVA - Swedish Governmental Agency for Innovation Systems.

Box 3.5 EU4Moldova: StartUp City Cahul – supporting innovation at the subnational level

StartUp City Cahul, run by the National Association of ICT Companies (ATIC) with EU support under the EU4Moldova initiative, aims to boost regional development through innovation in the digital economy. This is done through the Cahul Regional Innovation and Technology Centre, science, technology, engineering, and mathematics (STEM) education and training as well as ICT start-up support. The goal is to enable the diffusion of ideas and dynamism from Chisinau to the regions. With the strong engagement of local actors such as the ATIC and University of Cahul, coupled with support from the Chisinau-based Tekwill project, StartUp City Cahul can become a regional hub for innovation, not only in its own region but throughout Moldova, thus contributing to widespread innovation-led growth.

Source: The UNECE, based on http://startupcitycahul.md/en/.

Building on current policy initiatives, further efforts are needed to enable public-sector innovation, strengthen the private sector's absorptive capacities, increase the efficiency of the education and R&D sectors as well as tap into the potential of the Moldovan diaspora

Private-sector development policies should focus more clearly on building firms' innovation absorption capacity

As noted in Chapter 2, a leading constraint to innovation in Moldova is the inability of the private sector to systematically absorb, adapt and experiment with ideas. Despite the Government having strong ambitions in this area and already implementing a number of supporting policies, there is substantial room to more effectively build such capacity.

Innovation in private sector could benefit from more effective support infrastructure and mechanisms to increase absorptive capacities.

Financial and regulatory incentives and exemptions in Moldova are limited and do not clearly target innovation – in fact, given the high risks associated with innovation, measures such as corporate tax exemptions may serve as disincentives as they do nothing to diminish the initial risks. Many of these exemptions are also limited to residents of specific areas, such as the Moldova IT park and the seven Free Economic Zones. Businesses acquiring patents for inventions, utility models and new plant varieties would benefit from significant fee reductions[23]. The innovation voucher scheme was introduced recently[24], although no funding had been allocated for its implementation at the time of writing.

Support for innovative business ideas in Moldova is provided through the Network of Business Incubators (RIAM) and a range of start-up support organizations (detailed in Chapter 5) as well as the STPs and innovation incubators. However, current support for innovative entrepreneurship leaves much of the potential for further development and improvements untapped. For example, the STPs and innovation incubators, originally established to support innovative ventures, currently fall short of meeting this objective in a meaningful way.

Especially important for improving the private sector's absorptive capacity are training and educational programmes that are offered to businesses, typically by the ODIMM or using donor-supported initiatives such as Tekwill. To address the issue of the labour market skills mismatch, managerial and organizational-skills training programmes are also provided by the ODIMM and NGOs, such as the Chamber of Commerce and Industry of Moldova, the ATIC and private providers of business development services.

Weaknesses in SILs could be addressed by drawing on existing "pockets of excellence".

As Chapter 4 will further detail, science-industry linkages (SILs) in Moldova are quite weak if viewed from the conventional perspective of a one-way transfer of knowledge or the commercialization of innovation from R&D to the business sector. However, there is evidence that Moldova has several 'pockets of excellence', where effective SILs have been established in response to specific economic or social problems (e.g. IT services sector, the FEZs, several knowledge- and technology-based firms, examples in agri-food supply-chain). Therefore, building on the potential that these 'pockets of excellence' hold through policy co-creation would be an important mechanism to strengthen links to commercialize innovative outputs. Ensuring that firms, universities and the R&D system develop the right capabilities to carry out innovation, through mechanisms such as legislative frameworks and budget allocations, would also be critical in bringing new technology and ideas into the real economy.

To be effective, technology transfer needs strengthening through dedicated infrastructure and skills.

When it comes to technology transfers (TTs), Moldova`s infrastructure is under developed as the State University of Moldova has one of the few operational technology transfer offices (TTO) in the country and the staff at these offices need assistance to expand their capabilities. A positive in this regard is that the Government has already planned to address this shortcoming through the establishment of three Regional Centres for Innovation and Technology Transfer. In addition, a funding scheme under the state programme for technology transfer is also in place. This scheme has a budget of 8 million Lei and is administrated by the NARD to match the funding provided by private-sector involvement in TTs. Nevertheless, further action is needed to boost TTs and ensure their effectiveness in the Moldovan context, where other countries in the region could potentially provide examples of good practices (see Chapter 5).

Public procurement could become an important demand-side driver of innovation while simultaneously improving the efficiency of public services

Public procurement, when undertaken with the right strategic policy support, can become a powerful tool to boost the demand for innovation and stimulate broad experimentation with new ideas and technologies to attain economic, social, and environmental objectives[25]. Innovation enhancing procurement (IEP) is practiced by EU countries, such as Austria through its National Competence Center for Innovation Procurement at the Federal Procurement Agency, to provide a 'lead customer' or 'lead market' for an innovative product, service or process by offering large, early-stage purchases[26]. By taking on the role of a 'lead customer', the Government makes substantial economic gains as the early adopter of innovations and the procurement provides a measure of creditability to innovative products and services as they first enter the market.

With public procurement accounting for only 4.7 per cent of GDP in Moldova, untapped potential to drive the demand for innovation remains given Moldova's small domestic market, low levels of GERD and high costs to access foreign markets.

In an economy with a relatively small domestic market, high access costs to foreign markets for innovative local firms and low levels of gross domestic expenditure on R&D (GERD) such as Moldova, targeted public procurement could be instrumental in driving the demand for innovation and fostering innovation activity throughout the country. The use of IEP is based on the functional selection criteria for tenders, namely the specification of functionalities that the purchased good or service will provide rather than the specifications of the actual goods or services (e.g. the percentage reduction in costs to heat a building rather than a central heating unit that is smaller than the old models).

Despite a relative decline in the value of public procurement[27] (which went from 9.67 per cent of GDP in 2014 to 4.7 per cent in 2019)[28], it still has scope to act as a trigger for innovative development. Public procurement has undergone significant reform to comply with relevant EU Directives that were set out in the Association Agreement between the EU and Moldova. The e-Procurement platform M-Tender was introduced in 2017 and a new public procurement law was adopted in 2015 to better align Moldovan public procurement practices with EU requirements. However, continued reform efforts to enhance the public procurement system, coupled with progress on the digitalization agenda and assigning innovation a strategic role in socioeconomic development, could allow IEP to become a useful tool to address demand-side gaps in the national innovation system *(Recommendation 3.4.1)*.

Despite recent policy efforts, the education and R&D sectors require action to boost their quality, in particular in STEM education and PROs

In Moldova, STEM graduates comprised around 25 per cent of all graduates in tertiary education in 2019, which is a similar figure to comparable countries (e.g. Ukraine). While no policy has been put in place to increase the number of STEM graduates to address growing labour-market demand, particularly in the IT sector, implementation of the National Roadmap for Integration into European Research Area (ERA) 2019-2021, could have positive impacts on STEM graduate numbers. Complementing the road, donor-supported projects, such as Tekwill and StartUp City Cahul, play a crucial role in enhancing the quality of STEM education to meet private-sector needs.

Currently, there are approximately 50 PROs in Moldova that are subordinated to different ministries and agencies[29]. The Academy of Sciences of Moldova, previously in charge of R&D&I policy and most R&D infrastructure, now acts as an independent PRO with consultative functions that include advising the Government on science and innovation policy while supporting international collaboration on research. To increase the quality of PROs and with the competitive funding of R&D&I projects in place, the national NPRI 2020-2023 has provision for an audit of PROs with the assessment methodology under discussion. As detailed in Chapter 4, a restructuring of the R&D and education sectors in Moldova would help increase their degree of internationalization and the quality of their research outputs.

STEM education benefits from donor-supported initiatives while public research can benefit from international cooperation under different frameworks.

Substantial potential for improvements to the quality of local science and research lies in international cooperation. In this regard, Moldova can draw on the opportunities created under the Framework Programme of the European Union for research and innovation "Horizon 2020" (2014-2020) and the European Research Area (ERA), to which Moldova is an associate State. In addition, there is potential for knowledge exchange and transfer in sub-regional initiatives that Moldova participates in, such as the Danube Transnational Programme (INTERREG), COST programme, UN Environment/Climate and Clean Air Coalition Programme as well as other cross-border research and science projects (e.g with EU countries and Ukraine).

Public sector innovation has primarily focused on the digitalization of public services resulting in a loss of reform momentum and the need for renewed political to deliver results

Public administration reform and digitalization of government services are the two main drivers of innovation in the public sector in Moldova. Reform efforts were guided by several strategic documents[30] that expired in 2020 while the roadmap to boost the digitalization of the national economy and develop e-Commerce[31] continues to guide these efforts with extensive support from donors (USAID, GIZ, EBRD and EIB). Furthermore, the World Bank financed the "Modernization of Government Services" programme[32], which also contributed to improving access to digital public services, however, further investments and renewed political will are needed to make further substantial progress on the digitalization agenda.

In this vein, progress had been achieved by the MoE and e-Government Agency as, since 2011, more than 100 public services have been digitalized and made available through a dedicated platform. The MPay service, for example, allows payments for public services to be made online and has seen more than 700,000 transactions since its launch in September 2013.

Digitalization of government requires enhancing skills and capacities of the public servants to effectively support the reform.

Despite these welcome developments, progress in e-Government in Moldova is far from complete, in particular with regards to the quality and reach of the required telecommunications infrastructure, an issue highlighted by the lower scores Moldova achieved than comparator countries[33] on the e-Government Development Index (EGDI)[34].

Digitalization reforms require a significant process of learning new skills and adaptation on the part of civil servants that administer digitalized services as well as those civil servants who work in other, less directly connected areas of public administration. In this respect, the Academy of Public Administration of Moldova provides professional education programmes to train data analysts, programmers, network administrators and database administrators. This effort is complemented by vocational courses on the use of new information technologies in public administration and on the use of the 1C information system,[35] all of which are intended to support e-Government reform. Ensuring that civil servants' skills are continuously upgraded and there is an adequate supply of such well-trained individuals to meet e-Government reform requirements is an important priority going forward *(Recommendation 3.4.2)*. While donor-supported projects with capacity building components for civil servants contribute to this goal, dedicated vocational training and education programmes should be organized by the Government to ensure the success and the sustainability of reform.

The diaspora represents an additional powerful driver for innovative development, with the scope to build on the success of current and past initiatives

Around 1.2 million Moldovan nationals or individuals who identify as Moldovan live abroad, a figure that equates to one-third of the domestic population. This diaspora includes Moldovans who have settled temporarily or permanently abroad, and their descendants. The Moldovan diaspora has significant potential in terms of the economic benefits, social capital and technological advancements it could provide to Moldova in terms of boosting innovation and sustainable development. Meaningfully engaging and sustaining effective relationships built on trust with citizens living and working abroad is the primary task of any Government that wants to capitalize on the opportunities offered by its diaspora.

The successes and lessons learned from several diaspora engagement initiatives should be scaled-up and supported by effective, sustainable policy mechanisms.

The Government of Moldova has put diaspora engagement high on its agenda through "Diaspora 2025", which is a dedicated strategic document for this purpose, the establishment of the Diaspora Relations Bureau and the subsequent implementation of several initiatives with donor support (e.g. the International Organization for Migration and the United Nations Development Programme in Moldova). PARE 1+1, "Diaspora Succeeds at Home" and DARE 1+3 all aim to tap into diaspora savings and ideas to launch businesses or solve particular economic and social challenges that exist within Moldova. The programmes such as Temporary Return of Scientists (2010), Diaspora Engagement Hub (2013), and Diaspora Excellence Groups (2017) are examples of Government efforts, with donor support, to mobilize the diaspora to promote research and innovation in the country. Building on this foundation and drawing on successful international practices, the Government of Moldova could consider putting in place frameworks and policy mechanisms for effective and long-term diaspora engagement (see Chapter 6).

Policy Recommendations

The table of recommendations below builds on the analysis presented in this chapter on innovation governance. The recommendations made here involve only legal and institutional frameworks as well as policy coordination and alignment. Recommendations regarding innovation policy instruments are addressed as separate items in more detail in the following chapters. The recommendations are intended to provide some guidance for policy efforts that could be used to strengthen the national innovation system in Moldova. This guidance has been offered from the perspective of ensuring there are ongoing processes of systematic experimentation with new ideas and their implementation that can effectively target the socioeconomic and sustainable development challenges Moldova faces.

Table 3.1 Summary of policy recommendations on innovation policy governance

Recommendation 3.1: Reform and complement the **institutional and legislative framework** for innovation policy based on a broad definition of innovation and the imperative to build and nurture effective innovation systems.

The basic institutional and legal building blocks already exist, however, the right strategies, incentives and mechanisms are needed to ensure the alignment, additionality, complementarity and cost-effectiveness across all levels of government. This mix of strategies, incentives and mechanisms should be grounded in the imperative to understand and enhance the nascent national innovation system.

Actions	Priority	Time-frame	Roles
3.1.1. **Adopt a holistic approach to innovation policy governance** through, *inter alia*, comprehensive strategies and planning instruments that encompass and align policies and mechanisms that directly or indirectly support or affect the innovation system and ensure complementarity and the efficiency of coordination mechanisms, such as the proposed National Innovation Council.	①	Medium-term	The MoF, MoE and MER
3.1.2. **Enhance the legal framework for financing innovation** through, *inter alia*, legislation on venture capital and other forms of private equity coupled with clear and transparent mechanisms to attract and incentivize FDI in R&D intensive and innovation-oriented activities.	②	Short-term	The MER and Invest Moldova Agency
3.1.3. **Ensure that the legislative, institutional and public finance frameworks enable innovation policy initiatives at the subnational level** while remaining in line with national policy objectives to promote and facilitate local innovation in Moldova (including ongoing decentralization reform efforts).	③	Medium-term	The MER and MIRD

Recommendation 3.2: Strengthen **processes and institutional capacities** throughout the policy cycle, in particular, regarding stakeholder dialogue, and effective policy monitoring and evaluation.

With innovation being an unpredictable and risky activity, innovation policy processes require substantial flexibility to intervene when and where necessary to be effective and catalytic. Stakeholder dialogue and effective mechanisms to monitor and evaluate policy to find out what works and what does not are essential, however, these are currently insufficiently developed and mainstreamed in Moldova.

Actions	Priority	Time-frame	Roles
3.2.1. **Strengthen public-private dialogue to ensure systematic and constructive engagement of non-government stakeholders affected by innovation policy**, in particular the private sector, to increase the effectiveness of policy measures (e.g. through the Economic Council, Chamber of Commerce and Industry , or a future National Innovation Council).	②	Medium-term	The MIRD, MER, MoE, NARD, other relevant ministries and agencies

/…

Table 3.1 Summary of policy recommendations on innovation policy governance (Concluded)

Actions	Priority	Time-frame	Roles
3.2.2. **Make better use of online platforms for public consultations to ensure more systematic engagement of stakeholders in formulation of innovation policy** to increase its effectiveness (e.g. awareness-raising and promotion campaigns of the existing platform (http://www.particip.gov.md).	③	Long-term	The MER and all the Government
3.2.3. **Improve the monitoring of policy implementation** through increased public administration capacity and external evaluations to ensure systematic learning from results and the ability to modify or cease initiatives that do not achieve desired outcomes using clear performance criteria.	①	Short-term	The MER, NARD and all the Government
Recommendation 3.3: Enhance **policy coordination and alignment** across all levels of government to improve the targeting and effectiveness of policy actions.			
Innovation policy could benefit from better horizontal and vertical coordination based on the principles of additionality and efficiency to ensure that fragmented efforts lead to the accomplishment of strategic objectives.			
Actions	**Priority**	**Time-frame**	**Roles**
3.3.1. **Establish a National Innovation Council to coordinate and strategically guide innovation policy formulation and implementation**, based on the experience of other countries and adapted to the Moldovan context. Ensure that the council is supported by a clear mandate with matching resources, a comprehensive strategy and supporting secretariat.	①	Short-term	The Government (an initiative by the MER)
3.3.2. **Ensure, under the oversight and guidance of the National Innovation Council, that innovation policy aligns with other sectoral policies** for synergies in policy implementation and reporting for increased effectiveness. If a comprehensive national development strategy is adopted, the NIC should oversee the implementation of innovation-policy-related measures in the strategy.	②	Medium-term	The MER and all the Government
3.3.3. **Systematically engage subnational authorities** (i.e. at the district, municipal and autonomous territory levels) **in innovation policy processes (potentially through the NIC)** to ensure effective policy implementation locally and in line with national strategic objectives.	③	Long-term	The MER, MIRD and MoE
Recommendation 3.4: Accelarate innovation processes in the public sector through further eGovernment reforms and strengthen the demand for innovation via the introduction of innovation-enhancing procurement framework.			
After making some progress, e-Government reforms stalled, which has hindered innovation in the public sector. Building on initiatives in the digitalization of public services and public procurement, the Government can boost innovation in the public sector and significantly contribute to innovation-led development.			
Actions	**Priority**	**Time-frame**	**Roles**
3.4.1. **Establish a clear framework for innovation--enhancing procurement** as part of the overall reform effort to enhance the procurement system. This unlocks the potential for public spending to act as a leading demand-side driver of innovation and to enhance value-for-money. A pilot programme for functional procurement in selected areas could be established to determine what works at scale.	②	Long-term	The MoE and Public Procurement Agency
3.4.2. **To accompany the ongoing e-Government reform, mandate training for civil servants to enhance their digital literacy proficiency and expand other related skills** so they can effectively carry out the digital-service and digital-administration tasks assigned to them.	①	Medium-term	The Academy of Public Administration and MER

Source: The UNECE.

Notes

1 The Government approved a new criteria for financing research and innovation projects in decision No. 382, dated 1 August 2019.

2 Government of Moldova. (2020). *Republic of Moldova: Voluntary National Review, Progress Report 2020*. Chisinau: Government of Republic of Moldova.

3 Also reflected in the findings on Moldova in the UNECE Sub-regional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus.

4 https://mei.gov.md/en/content/activity-plan

5 Government Decision on Approval of the Government`s Action Plan for 2020-2023 (No. 635 from 11.12.2019).

6 The measures envisage streamlining the national research and development, and innovation (R&D&I) infrastructure through evaluation of national R&D institutions and R&I infrastructure mapping exercise; improving the policy framework for R&D&I.

7 Measures include smart specialization and clustering activities; creation of incentives for businesses to innovate, especially for the export-oriented companies to produce higher value-added products; promoting the implementation of advanced technologies through enhanced capacity of the product certification institutions; SME sector innovation through programme on clean technologies for SMEs and SMEs greening programme.

8 https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024/our-digital-future/era_fr

9 Spencer L. Tracy, J. (2011). *Accelerating Job Creation in America: The Promise of High-Impact Companies*. Washington DC.

10 The Programme and its Action Plan have been adopted by the Government decision no.1081 of 08.11.2018.

11 https://www.legis.md/cautare/getResults?doc_id=110232&lang=ro

12 https://www.legis.md/cautare/getResults?doc_id=115748&lang=ru

13 https://www.legis.md/cautare/getResults?doc_id=109755&lang=ro

14 UNECE. (2021). *Sub-regional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus*. Geneva: United Nations Publication.

15 https://consecon.gov.md/en/misiune/

16 The project is called USAID Moldova Future Technologies Activity. more information is available at https://www.chemonics.com/projects/promoting-innovation-through-new-technologies-in-moldova/

17 As of September 2021.

18 The Agency was renamed from the National Agency for Quality Assurance in Professional Education to the National Agency for Quality Assurance in Education and Research; the National School Inspectorate and the National Council for Accreditation and Attestation were merged with it.

19 Central and Eastern European Network for Quality Assurance Agencies (CEENQA), the Standing International Conference of Inspectorates (SICI), and it seeks to become a full member of the European Association for Quality Assurance in Higher Education (ENQA).

20 Recommendation of the European Parliament and of the Council of 18 June 2009 on the establishment of a European Quality Assurance Reference Framework for Vocational Education and Training (2009 / C 155/01);

21 Educational institutions where at least 50% of their accredited study programmes are eligible for accreditation.

22 Entrepreneurship and education strategies expired in 2020 and no new approved documents available.

23 The reduction of fees on IP stands at 85% if the purchaser is an SME and 95% of the fee amount along with an exemption from the payment of maintenance fees for invention patents for the first 5 years if it is a science and innovation organization.

24 As a result of the adoption of amendments to the methodology of funding projects in the fields of research and innovation. Details of these amendments are accessible at https://www.legis.md/cautare/getResults?doc_id=128301&lang=ro

25 The UNECE, Building Back Better: Innovation-enhancing Procurement for Sustainable Development, 2021 https://unece.org/sites/default/files/2021-05/ECE_CECI_2021_5_2103936E.pdf

26 *Ibid*

27 The procurement of works making up for half of the expenditures, followed by the procurement of goods (36.4%), and services (13.5%).

28 World Bank Group. (2021). *Moldova : Assessment of the Public Procurement System*. Washington, DC: World Bank.

29 PROs in Moldova are subordinated to three ministries and the State Chancellery. The majority are overseen by the MER (32) with the rest operating under the auspices of MIRD (8), the Ministry of Health, Labour and Social Protection (9) while the Academy of Public Administration is under the supervision of the State Chancellery.

30 Including the Strategic Programme for Technological Modernization of Government (e-Transformation), the Strategy to Reform Public Administration 2016-2020, and the Strategy on the Development of Information Society "Digital Moldova 2020".

[31] https://consecon.gov.md/wp-content/uploads/2020/09/eEconomy-Roadmap.pdf

[32] https://www.legis.md/cautare/getResults?doc_id=121730&lang=ro

[33] According to the UN E-Government Survey 2020 (United Nations, 2020), Moldova scored 0.68 and 0.71 on E-Participation Index (EPART), performing below sub-regional peers such as Belarus (0.8 on EGDI) and Ukraine (0.8 on EPART). Telecommunications infrastructure has improved somewhat from a low base (0.56 in 2020 vs 0.47 in 2018).

[34] The EGDI is a composite measure of three important dimensions of e-Government, namely: the provision of online services, telecommunication connectivity and human capacity.

[35] 1C: Enterprise system of programs is intended for automation of everyday enterprise activities: various business tasks of economic and management activity, such as management accounting, business accounting, HR management, CRM, SRM, MRP, etc.

Chapter 4

BOOSTING SCIENCE-INDUSTRY LINKAGES AND COMMERCIALIZING NEW TECHNOLOGY

Main messages

- The traditional science-industry links (SILs) perspective of direct transfers of knowledge from research and development (R&D) organizations to businesses does not capture all the aspects of science-industry collaboration in Moldova where such transfers are often driven by problem-solving needs rather than a desire to commercialize research results.
- In Moldova, three major sources of knowledge and technology seem to drive SILs, namely foreign firms and investors (FDI), domestic firms and public research organizations (PROs) in the national R&D system. These three groups of actors form the so-called 'triple helix' model of SILs.
- Effective technology transfers in Moldova require enhancing the linkages between TT infrastructure components, addressing bottlenecks in TT legislation, facilitating the creation of viable innovation hubs at the sub-national level and establishing TTOs able to provide feasible pipelines for TT projects.
- With its rich innovation support infrastructure, innovation activities are currently concentrated in and around the capital. Nation-wide development must have adequate and locally relevant regional infrastructure to close the rural-urban gap in innovation and address regional socio-economic challenges (e.g. through infrastructure specialization based on priority areas under smart specialization).

Recommendations at a glance: Boosting industry-science linkages and commercializing new technology

Recommendation 4.1: Strengthen the demand side of science-industry linkages (SILs) through targeted assistance mechanisms to increase access to and uptake of research, technology and development (RTD) services in the private sector to enhance the relevance and impact of public R&D investment.

Actions	Priority	Time-frame	Roles
4.1.1. Include private sector representatives in the National Agency on Research and Development (NARD) Supervisory Board.	②	Short-term	The Government and NARD
4.1.2. Enable wider private sector access to public R&D funding and subsidies.	①	Medium-term	The Government and NARD
4.1.3. Introduce innovation vouchers to facilitate and stimulate demand for R&D in the private sector.	①	Short-term	The Ministry of Economy (MoE) and Organization for Development of Small and Medium-sized Enterprises (ODIMM)
4.1.4. Enlarge the supplier development programme to enhance the private sector's absorptive capacity.	②	Medium-term	The MoE and ODIMM

Recommendation 4.2: Strengthen the supply side of SILs by increasing funding for R&D and ensuring an inflow of young researchers within the comprehensively reformed R&D sector.

Actions	Priority	Time-frame	Roles
4.2.1. Renew the young researcher support programme as part of an overall increase in the public R&D budget.	①	Short-term	The Ministry of Education and Research (MER)
4.2.2. Gradually restructure public research organizations (PROs).	①	Medium-term	The MER, Ministry of Health, Ministry of Agriculture and Food Industry
4.2.3. Differentiate universities as either research-based or vocational-education based.	②	Long-term	The MER

Recommendation 4.3: Enhance linkages between PROs and the private sector, including companies attracting foreign investment, by aligning private sector needs and commercialization potential with public R&D funding; upgrade the information and technology (IT) sector, an existing 'pocket of excellence', through closer links with higher education.

Actions	Priority	Time-frame	Roles
4.3.1. Extend NARD technology transfer projects to incentivize closer links between PROs and the private sector.	①	Short-term	The Government and NARD
4.3.2. Build the capacity of the Invest Moldova Agency to more effectively attract FDI.	②	Medium-term	The Government, MoE and FEZs
4.3.3. Enhance linkages between the FEZs and the rest of the economy.	②	Medium-term	The FEZs and MoE
4.3.4. Introduce mechanisms to link the IT sector with higher-education institutions.	①	Long-term	The MoE and MER

Source: UNECE.

Going beyond the conventional view for effective SILs in Moldova

The conventional view of science-industry links emphasizes a one-way transfer of knowledge or its means of commercialization from R&D sources to the business sector. There is a significant policy focus in Moldova on publicly funded research and its potential commercial applications. However, as this chapter shows, SILs in Moldova most often involves small- and medium-sized enterprises (SMEs) seeking assistance in solving problems related to production or certification issues rather than exploring ways to commercialize innovations discovered by publicly-funded R&D. In addition, SILs are very sector-specific, and accounting for the differences across sectors is crucial for policy to be meaningful.

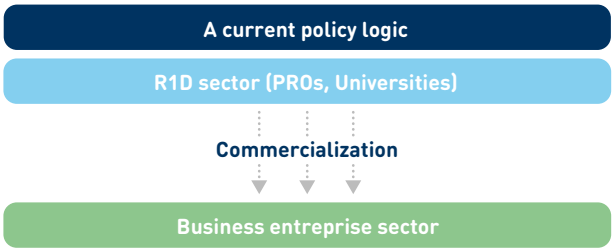
SILs in Moldova are best understood in the context of evolving the capabilities of firms, universities and the R&D system (see Albuquerque et al., 2015[1]). However, as these capabilities upgrade, the nature of SILs change. Finally, SILs should be seen in the context of three major sources of knowledge for firms – foreign technology and knowledge, firms' technological capabilities and knowledge from extramural R&D organizations

The below section outlines the approach based on the 'triple helix' model used for the analysis of SILs in this chapter, followed by the analysis of each of the three major sources of new knowledge and technology in Moldova – foreign firms, investors and partners (FDI), domestic firms and PROs in the R&D system. The analysis also extends to include the mutual linkages of these sources within the national innovation system before offering insight into the innovation systems in the agri-food industry and ICT services. The chapter also identifies existing 'pockets of excellence' and the potential 'network organizers' that lay behind them with the recommendation policies should seek to build on these existing 'pockets of excellence' to maximize the positive macroeconomic impacts. The final section of this chapter outlines key policy proposals that are geared towards stronger SILs throughout Moldova.

Explaining the Moldovan 'triple helix' of science-industry linkages

The conventional approach to SILs has a dominant focus on the role of R&D flowing from public sector organizations to industry which then incorporates these advances to produce commercial goods. However, interaction in the other direction, namely through industry experts getting involved in university faculties, is also recognised as necessary to develop and maintain strong SILs. (see Figure 4.1).

Figure 4.1 · A conventional view of science – industry linkages which underpin current Moldovan innovation policy



Source: The UNECE, analysis by the author.

A assessment of the intensity of university-industry R&D collaboration in the World Economic Forum (WEF) Global Competitiveness Reports shows a poor state of collaboration in Moldova. The intensity of collaboration is well behind all other comparator countries except Georgia, which is the closest comparator. However, this assessment captures only one dimension of SIL – R&D collaboration – and does not address other dimensions that have particular relevance to Moldova.

The conventional approach to SIL, as depicted in Figure 4.1, is on the surface justified but in reality far too narrow. Figure 4.2 shows that a variety of SILs exist and ranks them based on their relevance to Moldova. Training graduates and the generation of public knowledge currently represent the most central function of the R&D system, followed by informal, knowledge-based and problem-solving services. The commercialization of innovative discoveries, especially by new firms being spun out of public R&D, is a small-scale activity in Moldova.

SILs should extend well beyond the national innovation system to form meaningful links with FDI partners as key sources of innovation.

In addition to the domestic SILs, links between FDI and domestic firms, HEIs and research institutes are extremely important. This is due to the substantial inflow of knowledge through FDI and supply-chain relationships (subcontracting) as well as exports. Furthermore, PROs in Moldova can access international knowledge networks through international projects, including Horizon Europe and various Erasmus exchange programmes, making such essential international links a readily available component for the R&D sector.

The triple helix model of SILs in Moldova includes foreign firms, investors and partners, as well as domestic firms, and the public research organizations (PROs).

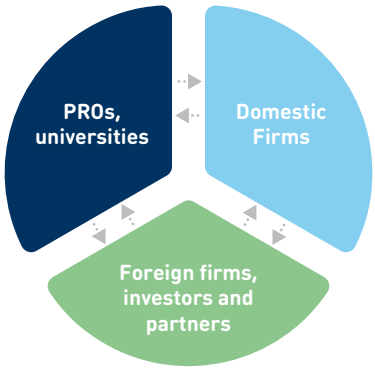
Domestic firms rely on foreign knowledge sources for licensing, reverse engineering endeavours and collaboration with both customers and parent companies. Initially, local knowledge is used to complement core technological knowledge from abroad. However, as countries upgrade, the role of local sources of knowledge, including R&D, increases, and consequently, the domestic links gain importance. Therefore, the current state of SILs in Moldova should be seen in this context of current firm and R&D system capabilities and their relationship with foreign partners (Figure 4.3), where the the links to foreign partners are as important, if not more so than the former.

Figure 4.2 · A taxonomy of science-industry linkages in Moldova ranked on their relevance

Generating public knowledge and training	**1. Training skilled graduates** **2.** Increasing the stock of useful knowledge (publications, patents and copyright);
Problem-solving, informal knowledge transfer and knowledge-intensive services	**3. Providing knowledge-based services (testing, certification and metrology etc.)** **4.** Providing informal networking and knowledge networks **5. Ensuring scientific and technological problem solving**
Commercializing	**6.** Ensuring the sale of intangible knowledge (patents, plant varieties and know-how licences) **7.** Creating new firms

Source: The UNECE, analysis by the author.

Figure 4.3 · The Moldovan triple helix model of science industry linkages



Source: The UNECE, analysis by the author.

Assessing the components of the Moldovan triple helix model

Based on statistical evidence, the next sub-section complements the discussion in chapters 1 and 2 and assesses the strength and intensity of each of the three helices of the model: (1) foreign firms, investors and partners, (2) domestic firms as well as (3) public research organizations and universities.

Foreign direct investment: still limited inflows but good potential

Moldova has substantial untapped potential to benefit from FDI for knowledge diffusion.

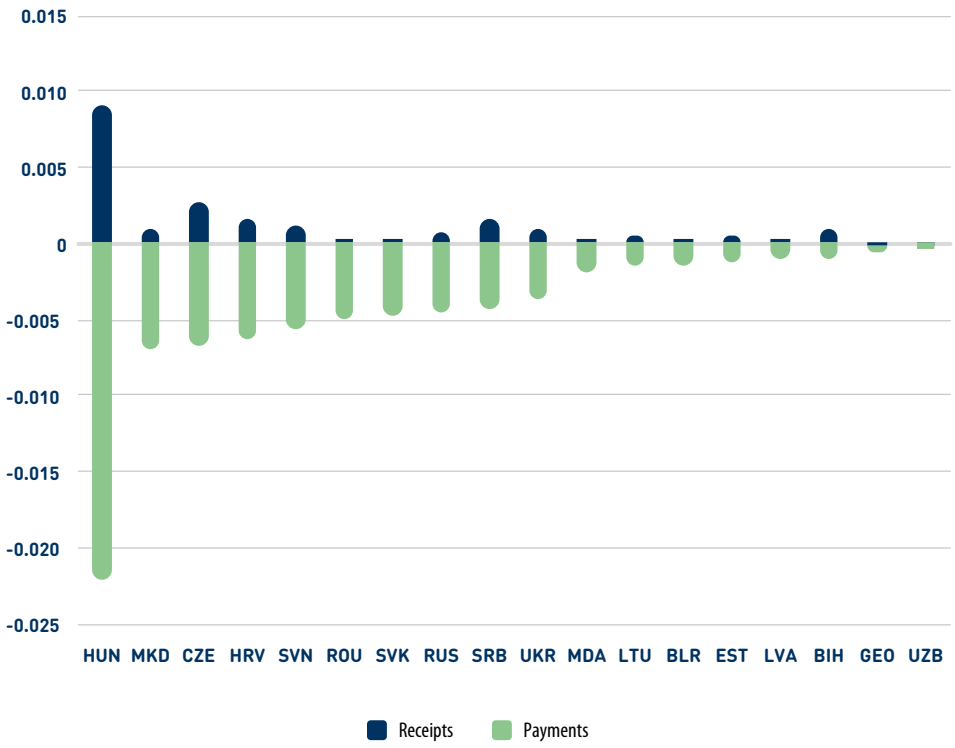
With its strategic geographical location, Moldova has excellent opportunities to join Central European industrial networks and integrate the EU's and other markets' supply chains. However, this potential remains significantly underutilized, as discussed in chapter 2 and as earlier studies have shown[2]. Policymakers face two immediate challenges in this regard. First, there is a need to devise and implement a comprehensive investment strategy to improve the investment environment to derive more developmental benefits from FDI. Second, greater coordination among government institutions is required to enhance the adoption and effectiveness of international best practices to make foreign investment in Moldova more appealing[3].

When it comes to the acquisition of foreign intellectual property rights through licences and other IPR (software etc.), this channel of knowledge acquisition is relatively marginal in lower-middle-income economies, and Moldova is no exception in that regard (see Figure 4.4.). With negligible technology receipts and a technology payments bill standing at 0.002 per cent of gross domestic product (GDP), the situation is broadly in line with peer economies. Its low level of technology payments also reflects on average the low knowledge intensity of FDI.

Enhancing domestic supply chains and local firms' involvement in foreign supply chains is one of the most effective ways to assist with upgrading the technology of local firms.

In addition to FDI and technology payments, there are other two channels of knowledge inflows into Moldova: the internationalization of R&D activities and integration through international supply and service chains. Unfortunately, comprehensive statistics on these inflows are not available and, as such, the next section presents only limited information regarding these flows.

Figure 4.4 · Technology balance of payment: Receipts and payments as an average percentage of GDP 2014–2019



Source: The UNECE, based on the World Bank Development Indicators, 2020.

Enhancing domestic supply chains and local firms' involvement in foreign supply chains is one of the most effective ways to assist with upgrading the technology of local firms and ensure they have greater market access. In this regard, the Government of Moldova could consider enlarging its supplier development programme *(recommendation 4.1.4)*. This would help enhance SME innovation capabilities and prepare them to establish long-term supplier relationships with medium-sized and large enterprises, including foreign companies (the so-called 'integrators'). The programme would include the medium-sized and large enterprises and then select specific SMEs from among those that wish to become their suppliers, identifying clear aims and co-operating on product and process innovation. Co-funding of innovation projects by 'integrators' and SMEs should increase the likelihood of local SMEs integrating into international supply chains. Given its successful track record in implementing similar programmes and its credibility among international donors, ODIMM seems the best-suited entity to implement such a programme. However, as previously noted, coordination among government institutions is a sound strategy and ODIMM's efforts would significantly benefit from complementary policy support from the Moldovan Investment Agency.

In summary, aggregate FDI inflows remain very limited in Moldova, contributing to employment and technology upgrades in only a few sectors. Nevertheless, FDI's potential to open up new areas of growth should not be underestimated, as the chapter will further show.

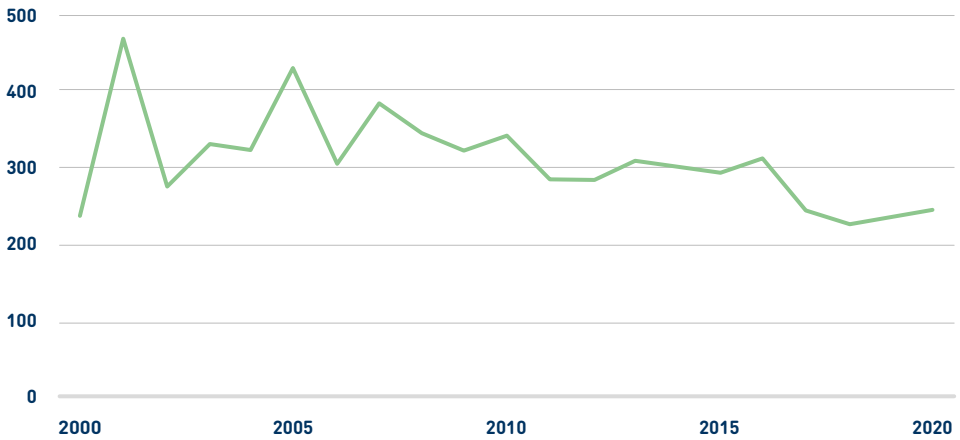
The R&D sector requires restructuring for enhanced quality and efficiency

R&D capacities exist but lack adequate quality and resources (incl. human) with 'brain drain' an additional challenge.

Input indicators for the Moldovan R&D system show marginal investment in terms of financial and human resources and accordingly limited outputs in terms of scale and the impact of activities such as both domestic and international publications and patents. An assessment of the quality and availability of R&D services returned mixed results. There is comparatively good availability of research and training services, however, the quality of R&D organizations, and especially the availability of scientists and engineers, is among the lowest in the peer group (see Figure 4.6). So, while notionally R&D capacities exist, both the quality and availability of personnel are comparatively low. This can be partially explained by 'brain drain' from the R&D sector which has strongly contributed to a hollowing out of many local R&D institutions. For example, the number of employees engaged in R&D activity in Moldova fell from 5033 (2015) to 4058 (2019), which is a decline of 20 per cent in only four years. This decline was accelerated by the sudden shift of the R&D sector to a competitive funding system, which led to a significant number of layoffs from projects that did not receive funding. As can be expected from this decline, the number of patent applications fell from its peak twenty years ago and is now in gradual decline (Figure 4.5).

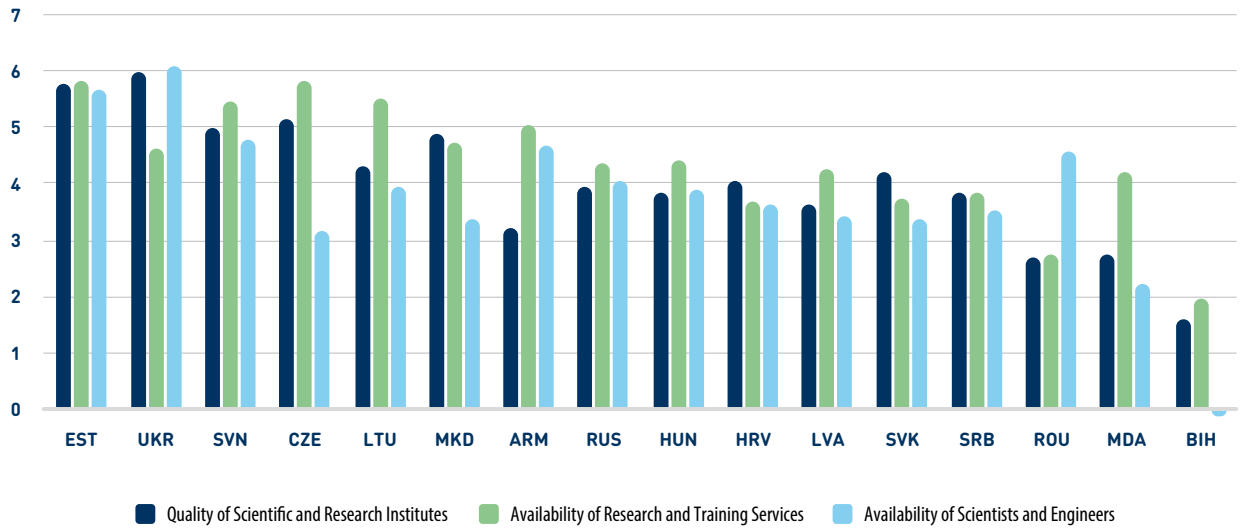
In addition, the Moldovan R&D system is not sufficiently internationalized in financial terms. Funding from abroad declined to only 5 per cent in 2019 from the approximate 10 per cent level it enjoyed between 2009-2015. One notable consequence of this is that the substantial opportunities for R&D cooperation under the Association Agreement with the EU remain unrealized. The assessment of the quality and availability of R&D services in Moldova shows a low level of satisfaction with the quality of R&D institutes by the private sector (2.7 on a 7-point scale) (Figure 4.6). Although the availability of research and training services was assessed as similar to many other comparator economies, Moldova has a very low availability of scientists and engineers as a result of the long-term depletion of the R&D system.

Figure 4.5 · Total patent applications in Moldova 2000–2020



Source: The UNECE, based on Moldova's State Agency on Intellectual Property (AGEPI) http://www.db.agepi.md/Inventions/panorama/1.

Figure 4.6 · Quality and availability of R&D services in Moldova and comparator countries, 2020



Source: The UNECE, based on the World Economic Forum Global Competitiveness Report, 2020.

For the R&D sector to move to the next level of quality and efficiency, government spending on R&D should be increased alongside PRO restructuring.

With a new, competition-based system of R&D funding in Moldova, 80 per cent of R&D is performed in government institutes and universities (around 70 per cent and 10 per cent respectively). The low figure for R&D undertaken by universities means there are limited opportunities for the integration of foreign research and teaching and explains, to a certain extent, the limited internationalization of the higher-education system. This is aggravated by the R&D system being dominated by a relatively old demographic with 20 per cent of the sector's workforce being 65 years of age or older in 2020, a figure which rises to 75 per cent for applied R&D activities. This raises the risk that R&D could be increasingly limited to the cultural functions of science rather than contributing to the country's socio-economic development. The limited technological and developmental gains generated by the R&D sector are not keeping pace with Moldova's needs, meaning the sector is becoming increasingly irrelevant to the local economy.

In essence, the R&D sector currently operates in 'survival mode' and requires a significant overhaul to flourish. However, restructuring the R&D system with the current very low levels of funding is a zero-sum game, meaning that seeking even marginal systemic improvement purely through restructuring is unattainable. Such an example would be the abolition of the programme of support to young researchers following budget cuts.

A gradual increase in the R&D budget would help enable the internationalization of the R&D system, fund a young researcher support programme and allow better participation in EU R&D initiatives.

To ease this situation, the Government of Moldova could gradually increase the R&D budget by 0.1 per cent of GDP each year for the next five years. However, while increased funding is crucial to improving the sector's performance it will need to be supported by several high priority policy measures. First, the Government should re-establish a programme that supports young researchers *(recommendation 4.2.1)*. R&D systems are slow to evolve and tend to suffer from inherent inertia, as such, supporting young researchers should be seen as a necessary long-term commitment towards restructuring the sector and improving its scientific excellence. The renewed programme should

a) commit to annually increase, by a specific number, the employment of young researchers for five years and b) include a component that strongly encourages the internationalization and co-funding of international mobility schemes for young researchers. In addition, the Government could explore further opportunities to integrate this programme into EU co-funded schemes in the area of R&D .

In addition, Moldova should consider significantly expanding NARD technology transfer projects using funds from the increased public R&D budget *(recommendation 4.3.1)*. NARD technology transfer projects are the only existing mechanism in Moldova that supports cooperation between the business sector and public R&D organizations. Interest from both sides for these calls is very high, however, the major constraint is the very limited total budget envelope, a situation that is further complicated by limits to the size of individual projects.

Expanding NARD technology transfer projects would allow better cooperation between the business and public R&D sectors.

Increased funding for technology transfer projects should match increases to the overall annual budget for R&D. This prevents a zero-sum game between innovation and R&D-oriented public funds and could also contribute to increased demand for domestic R&D services from the private sector and drive its innovation.

Finally, to enhance the capabilities of the PROs, they should be gradually restructured in line with the country's strategic development objectives and with due transparency of policy discourse *(recommendation 4.2.2)*. The prolonged erosion of the R&D system and threat of further R&D budget cuts has led to strong resistance to change within public research organizations. Faced with barriers to the active restructuring of the R&D system, the Government opted for a more implicit means of restructuring by introducing a strictly competition-based selection process for R&D project proposals. This selection process, which has minimal involvement from international peer reviewers and a high rejection rate, was perceived by Moldova's small R&D community as both deficient and lacking transparency. The continuation of this approach may seem a politically acceptable way to rationalize the R&D system but it will not necessarily lead to improved performance and relevance.

The R&D sector should be gradually restructured to enhance the quality of research outputs and better SILs.

In other words, changing the funding rules alone will not lead to an optimized R&D system as direct restructuring remains an inevitable requirement. This restructuring could take different approaches, such as incorporating applied research institutes into a Fraunhofer-style national institute[4] oriented towards the business sector, the incorporation of certain other research institutes into universities or the conversion of some research institutes into 'commercial' public R&D companies.

The Moldovan business sector lacks the capacity to systematically absorb new knowledge and technology

As detailed in chapter 2, private sector investment in R&D is very low[5] and the scale of R&D demand coming from it is also quite limited. Currently, most innovation in Moldovan firms happens in downstream production activities (e.g. activities related to improved production capability, quality and product differentiation) rather than in upstream innovation activities (e.g. internal or extra-mural R&D).

Firms' organizational capabilities require improvement as these are crucial to the capacity to absorb innovation.

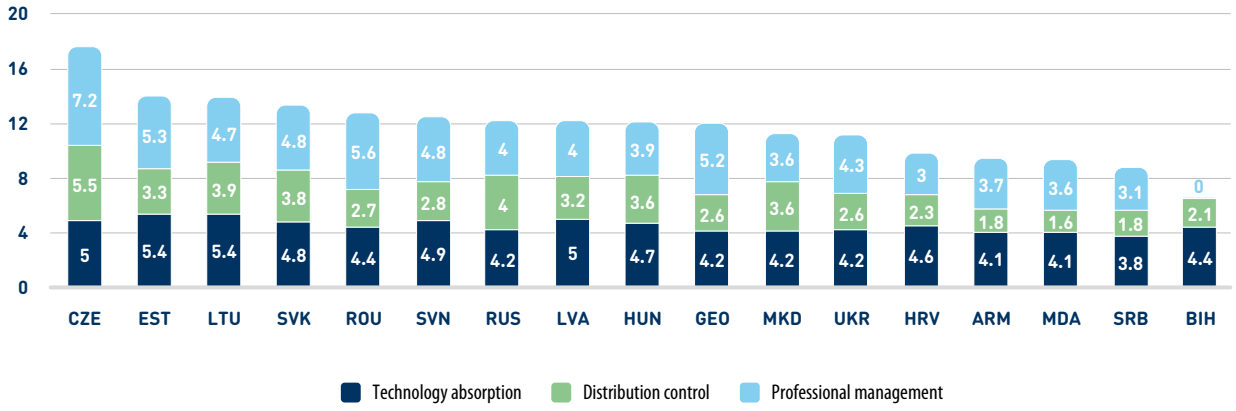
Each firm's organizational capabilities, namely the way people and resources are internally combined to accomplish work, are important for its capacity to absorb innovation.

Firm technology absorption capacity, control of international distribution and reliance on professional management are valuable proxies to evaluate the level of these absorptive capacities. Figure 4.7 shows Moldovan firms have significant untapped potential in this regard, including a near-total dependence on value chain partners to access foreign markets.

In summary, the foregoing confirms that the Moldovan business sector has very limited linkages to R&D. A contributing factor for this, not made apparent from the above, is the dominance of non-R&D intensive sectors in the Moldovan economy. This means that most Moldovan firms are focused on non-R&D intensive activities that are aimed to improve quality, productivity and market acceptance of products and services. Such non-R&D activities also include skills development of labour force as essential to further technology upgrading.

The brief overview provided below (Figure 4.8) shows the limited involvement of the Moldovan private sector with innovation (i.e. acquisition of external knowledge at 0.7 per cent of firms` expenditure on innovation activity) which largely explains the private sector minimal R&D linkages with universities and research institutes. Thus, the innovation capabilities of local firms will, in many ways, determine the extent and scope of cooperation with the science sector.

Figure 4.7 · Assessment of the organizational capabilities of firms, 2019 (1-7 best)



Source: The UNECE, based on the World Economic Forum Global Competitiveness Report, 2019.

Figure 4.8 · Structure of firms' expenditures related to innovation in industry in 2018 (Percent of total expenditures on innovation)

	Own R&D	External R&D (procured from other firms)	Purchases of machinery, equipment and software	Acquisition of external knowledge	Other innovation activities
Industry	23.8	1.1	70.5	0.7	3.9

Source: The UNECE, based on the Innovation survey by the National Bureau of Statistics of Moldova (https://statistica.gov.md/newsview.php?l=ro&idc=168&id=6541#idc=558&).

The main partners in innovation activities are upstream (suppliers of equipment, materials, components or software) and downstream value chain partners (customers or buyers) which, between them, are involved in the innovation activities of 53 per cent of innovative enterprises. By way of comparison, universities and research institutions are cooperatively involved with only 6 per cent of innovative enterprises (Figure 4.9).

Innovation in the business sector depends on the capabilities of PROs to provide quality R&D and match the needs of firms.

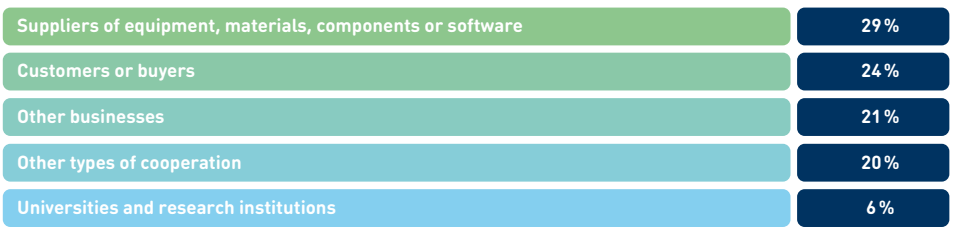
The real challenges to upgrade and innovate in Moldova do not lie in an intensive internal firm R&D component or R&D capacities to implement it, but in the limited capabilities of extramural R&D organizations to meet the R&D quality and quantity needs of the private sector. This makes the training of skilled graduates one of the most important steps to build and strengthen science-industry linkages and commercialize new technology. The relationships here are all direct, the quality of training reflects in the quality of the graduates which, in turn, has a direct bearing on research quality undertaken at universities and other R&D organizations that employ these graduates.

Currently, Moldovan universities score poorly in the global rankings with the Technical University of Moldova and State University of Moldova, ranked 3403 and 3838 respectively, being the two highest-placed institutions[6]. For comparison, the top 100 CEE universities in these rankings range from 141 (Charles University, Prague) to 1615 (Technical University of Czestochowa, Poland). Going forward, it is important to enhance the quality and international position of Moldovan universities to support the development of R&D centres of excellence throughout the country. Differentiating between universities as either research-based or vocational education-based could be an effective tool to reach this objective *(recommendation 4.2.3)*.

Enhancing the quality and international ranking of Moldovan universities could be supported by differentiating between those that are research-based and those that are vocational education-based.

Some universities could begin the process of developing into research-based universities by integrating into networks of global and European universities (e.g. the EC Erasmus programme for research-based teaching practices). This has the added benefit of increasing the opportunities of securing external R&D funding for university research projects. This, in turn, has flow-on effects that help such integrated universities meet the criteria of R&D excellence and international standard to improve their rankings and contribute to their internationalization. The non-research-based universities would ideally focus on the excellence of their vocational training using rigorous criteria, including professional bachelor and master's degrees and practice-based doctoral degrees. In this respect, Moldova could accelerate the development of this model by learning from and

Figure 4.9 · Structure of innovative products and processes in Moldovan firms according to the type of cooperation



Source: The UNECE, based on the Innovation survey by the National Bureau of Statistics of Moldova (https://statistica.gov.md/newsview.php?l=ro&idc=168&id=6541#idc=558&).

partnering with countries that have developed similar high-standard vocational training systems (e.g. Germany). Furthermore, these universities would be central to SILs to transfer the latest applied technical knowledge to local businesses.

Building the capacities of both the business and R&D sectors would strengthen SILs in Moldova, with the experience of emerging business ecosystems leading the way.

Both types of universities would have to create strategic alliances with reputable universities and excellence centres to support their respective areas of focus. They could then offer the Moldovan business sector direct access to modern technologies and relevant knowledge, providing additional incentives for enterprises to engage in university R&D projects and positively affect SILs.

The analysis of each strand of the Moldovan triple helix shows the limits of conventional SILs to act as the driver of innovation-led growth and technologically upgrade the economy. As such, policy should recognize the changing nature of business ecosystems in the economy and try to enhance the emerging linkages within these ecosystems. Naturally, one of these links is the traditional SIL (where PROs are the producers and businesses are the recipients of R&D), however, these should be seen in the context of a wide variety of business ecosystems within the Moldovan economy. Interviews conducted for this review and the study of the available data show five key emerging business ecosystems in Moldova, namely; the IT service sector; FDI in free economic zones; technology-based firms; knowledge-based firms in traditional industries; and agri-food supply chain. Each ecosystem has a different level of maturity, objectives, macroeconomic relevance, scale and scope, nevertheless, they all have the potential to provide growth, employment and export dynamism and warrant policy attention. A brief overview of some key aspects for each ecosystem is provided below in Table 4.1.

Business ecosystems in Moldova and their knowledge linkages

Table 4.1 Overview of the emerging business ecosystems in Moldova

Name	Key characteristics	Key Constraints	Way forward
IT service sector	• low barriers to access foreign markets • proximity to EU partners • market composition: 80% outsourcing and 20% domestic • Moldova IT park contribution - preferential tax regime, i.e., 7% single tax for residents	• the limited size of the potential labour force • dominant outsourcing model constraining efforts to upscale higher value-added services (e.g., data analytics, product management) • weak links with universities on R&D collaboration	**Linking the IT sector to higher-education institutions through:** • investment in the skills of IT graduates (e.g., modernizing the IT curriculum) • better collaboration with universities (incl. on international R&D activities) • supporting ongoing programmes on IT education by Moldovan IT association (ATIC) and donors (e.g. USAID)
FDI in free economic zones (FEZs)	• Balti and Ungheni FEZs are the most successful (automotive and textile industries respectively) • zero corporate income tax, exemption from excise and customs duties; 10-year state guarantee on legislation changes, low-cost land, minimal state inspections and control regimes, internal payments in euros/dollars • export centred FEZs (75% of sales are to international clients) with most export sales concentrated in a few companies	• domestic value-added is limited by low wages as well as exemptions for fees and taxes normally payable on land, buildings, services • locally sourced inputs seem to be marginal • weak links of FEZs to the rest of the economy • room for better FDI attraction through Invest Moldova Agency	**Enhancing links between FEZs and the rest of economy via:** • adding an industry focus or technology specificity to FEZs to accumulate a critical mass of skills transferable to the business sector • facilitating the integration of local SMEs into the supply networks of firms in FEZ • integration into GVCs • ensure development benefits from FDI

/...

Table 4.1 Overview of the emerging business ecosystems in Moldova (Concluded)

Name	Key characteristics	Key Constraints	Way forward
Technology-based firms	• still rely on the legacy of Soviet-era R&D institutes with dated and limited R&D capabilities • sometimes involved in publicly funded R&D and technology transfer projects as PROs • close links through master's and doctoral programmes facilitate informal knowledge exchange with universities and R&D institutes	• inadequate infrastructure within the national innovation system, including metrology services • lack of sophisticated local buyers • high barriers to entry into developed markets	**Strengthening the development of technology-based firms through better access to public R&D funding by:** • facilitating private sector participation in R&D grant calls organized by NARD using clear and transparent criteria for participation
Knowledge-based firms in traditional industries	• high macroeconomic significance, both in terms of employment and export volume • often based on endogenous knowledge, i.e., the result of accumulated individual or firm-specific knowledge • links with R&D and other external organizations is confined to testing and certification services	• limited cooperation with foreign technology providers and local PROs to adapt new technologies suited to the local context • capacity to adapt technologies to local conditions	**Strengthening links between local firms and domestic R&D organizations for better innovation absorption via:** • enhancing capacities of R&D sector to ensure better quality of outputs and their relevance to the local economy
Agri-food supply chain	• large workforce and significant exports, although these are concentrated in low value-added products • agricultural R&D institutes operate as 'problem solvers', testing facilities, quality checkers or help to ensure good practices through extension services • collaboration between R&D organizations and other agri-food actors is rarely formal as it is usually based on individual links • wine, and to some extent fruits have been gradually upgraded through FDI and international donors' support	• fragmentation of agri-food value chain • lacking investments in rural areas by processors at the intermediate stages of the value chain • stringent product standards, incl. for exports • extension services often operating in isolation from the sector • poor cooperation between agribusinesses and research institutes in the sector	**Helping gradually move production to higher value-added activities by:** • supporting existing collaboration and facilitating the creation of links between the R&D sector and food processors, extension service providers and aggregators

Source: The UNECE, analysis by the author.

Having painted a broad overview of the key areas under consideration, the sections below will provide a more detailed analysis of each ecosystem and offer guidance on options to best utilize their potential to benefit the whole economy.

IT services sector: building linkages with the wider economy to drive development

As is the case with IT sectors in many CEE countries, the Moldovan IT sector is one of only a few sectors that face low barriers to access foreign markets. Significant differences in labour costs, the supply of local graduates motivated to engage in programming and outsourcing activities as well as Moldova's proximity to its EU partners have led to an emerging ecosystem of companies operating in different segments of the IT services industry. The types of companies range from the usual outsourcing centres to independent software vendors, global vendors, system integrators, start-ups and companies addressing technology or industry niche needs.

The IT sector in Moldova has grown dramatically, most notably in outsourcing services.

The Moldovan IT services market was estimated to be worth approximately $154 million in 2018, of which 80 per cent came from outsourcing and 20 per cent from the domestic market[7]. This market and ecosystem have merged spontaneously and to date employ some 25,000 IT specialists. In 2019, IT sector exports (telecommunications, computers and information services) amounted to $254 million[8]. The Moldovan IT Park has contributed greatly to this development with its 7 per cent across-the-board tax rate for park residents. This has cut labour costs and provided a unique special economic zone unavailable to other local firms. However, it is only a matter of time before firms start to hit the limits of the current growth model.

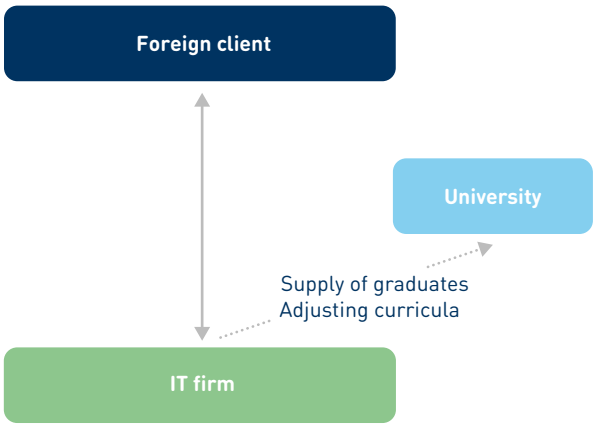
The limited size of the potential labour force is one of the main barriers to the sector's further development of high value-added activities, which is an inevitable transition if IT firms are to remain competitive. As most companies operate an outsourcing model, the overall labour pool is limited for further upscaling as would require a different skillset. Increasing engagement in high value-added activities, such as data analytics, product management and innovation-driven projects requires investing in the skills of IT graduates and building more effective collaboration with universities.

Further IT sector success depends on companies' capacity to undertake high value-added activities, this requires an adequate supply of skilled graduates and modernized ICT education.

At present, the IT sector does not have any meaningful R&D collaboration with universities and linkages between the two are generally confined to training students. While SILs in the conventional sense are non-existent, the sector is highly dependent on the inflow of graduates and is very much interested in both modernizing the IT curriculum and cooperating with universities in international R&D activities. Going forward, establishing mechanisms to link the IT sector to higher-educational institutions would be extremely beneficial.

These mechanisms would ideally be accompanied by measures to modernize IT education methods and curricula, building on donor initiatives (e.g. USAID) and the efforts of ATIC to develop R&D linkages with international centres of excellence. Adopting this multi-pronged approach will enable local IT firms to rely on Moldovan universities as key sources of new IT and AI knowledge *(recommendation 4.3.4)*.

Figure 4.10 · IT sector science-industry links



Source: The UNECE, analysis by the author.

FDI in free economic zones: building linkages with local supply chains

Since their establishment in 2001 in Moldova, FEZs have seen their workforces double between 2008-2016[9], mostly driven by outcomes in the Balti and Ungheni zones, where major automotive and textile firmss are located. Firms in FEZs enjoy zero corporate income tax, are exempt from excise and customs duties; benefit from a 10-year state guarantee on legislation changes, low-cost land, minimal state inspections and control regime as well as being able to make internal payments in euros/dollars.

In addition to their positive effect on employment, Moldovan FEZs are very export-focused (75 per cent of sales are to international clients). Nevertheless, these export figures are dominated by only a few companies (Liar Corporation, Gruber and Gruber, Drexel Maier). Furthermore, most of the inputs for these sales are imported and the taxes paid as a result of FEZ-based activities are less than 1 per cent of national tax revenue with most of this coming from employees' income tax[10]. As a result, domestic value added is confined to the wages of employees, the limited fees and taxes paid by companies for land, buildings and services, while locally sourced inputs seem to be marginal. This situation calls for an in-depth analysis of the costs and benefits of FEZ as well as a re-evaluation of their objectives.

In Moldova, Balti and Ungheni FEZ have seen important success in driving employment and exports in the automotive and textile industries but with limited spill-overs for the rest of the economy.

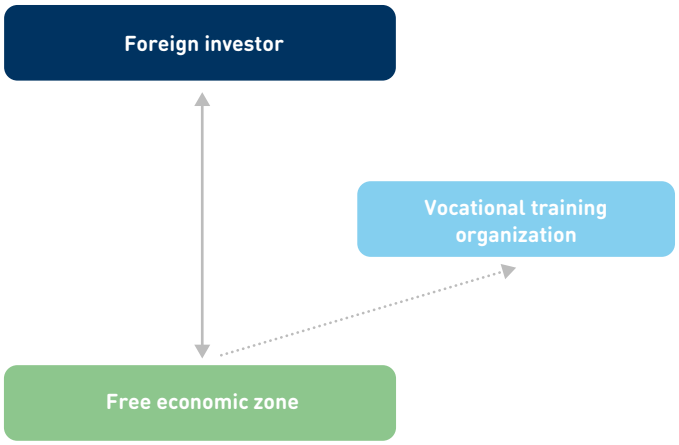
To ensure that FEZs have meaningful positive spill-over effects on the economy as a whole, including when it comes to growth and sustainable development[11], it is crucial to ensure the integration of FEZs into global value chains (GVC) and technology upgrading[12]. FEZs should be technology-focused or industry-specific rather than be a mix of the two and should build on existing competitive advantages and capabilities. This would assist the generation of the critical mass of skills that can be transferable among firms.

FEZ should be better integrated into GVCs and build linkages with outside firms through supply networks and training programmes to ensure innovation and technology transfer.

An excellent example of this new policy direction in this regard is establishing a vocational training centre and the planned engineering education programmes in the Balti FEZ to meet the needs of the automotive company located there. This change should be part of a trend to facilitate the growth of FEZs, not through fiscal incentives but through support services. Such policies would also need to develop the supply capabilities of local firms to facilitate the integration of local SMEs into the supply networks of firms in FEZ *(recommendation 4.3.3)*. Furthermore, success in doing this will require complementary measures implemented by both ODIMM and the Moldovan Investment Agency to target the development of FEZ ecosystems. Finally, matching efforts and training programmes with firms within and outside the zone will significantly boost the benefits that flow from FEZs to the broader economy[13].

In a nutshell, FEZs and the IT park are currently underperforming assets with the potential to create significant employment and development opportunities for Moldova if they can overcome their extremely limited supply linkages to and spill-over effects for the broader economy. Rapidly establishing conventional SILs cannot currently be achieved with Moldova's existing capabilities. However, the successful example of the Balti FEZ shows that these capabilities can be created and built upon domestically. To accelerate this process, FEZ's need to be promoted and supported as catalysts of skill formation and facilitators that allow the economy to be technologically upgraded. This will require a concerted effort on the part of the Government to ensure policy coordination and the co-creation of a favourable business ecosystem in partnership with FEZ managers, local authorities and international donors *(recommendation 4.3.3)*.

Figure 4.11 · Free economic zones' knowledge links



Source: The UNECE, analysis by the author.

The Invest Moldova Agency has an important role to play in improving the visibility of Moldova and attracting investments that have high potential to drive innovation and knowledge transfer.

In addition to the above, the innovation potential of FEZs can only be maximized if the capacities of the primary FDI tool, the Invest Moldova Agency, are enhanced to effectively use and attract FDI *(recommendation 4.3.2)*. This agency has already improved the visibility of Moldova to foreign investors but there is still much room for further improvement in its role as the focal point for foreign investors. As such, it is recommended that the agency integrates a project-based approach and remuneration system built on performance-based contracts with an integrated evaluation system. An example of a good-practice model that is well-suited to Moldova's needs is CzechInvest, the Czech republic's key FDI agency[14]. In Moldova, such an effort could be supported by an international donor initiative with a Government commitment to further sustain and develop it.

Technology-based firms: specialised suppliers in search of markets

Technology-based firms have upgraded their R&D capabilities during the economic transition, and have collaboration with R&D institutes in specific areas.

Technology-based firms in Moldova operate under the legacy of Soviet-era R&D institutes and their R&D capabilities which have been largely preserved, although somewhat upgraded in the transition period. Two examples of such firms are TOPAZ and ELIRI, both of which are R&D-based private companies that actively collaborate with the R&D institutes in their fields. For example, TOPAZ is a specialized supplier in the aviation industry very closely integrated into the Russian industrial network but is also involved in publicly funded R&D projects. Its capabilities are rooted in the Soviet-era school of electro physics, and its 180 employees have several PhDs and MSc.

ELIRI emerged from the Soviet-era construction bureau and is now a private R&D company with 30 employees. Its operations focus on new materials (micro- and nano-wires) and half of its sales involve the export of technology-intensive specialized supplies. In the local market, while they are mainly involved in problem-solving services in their area of expertize, the firm is also engaged in a technology transfer project of NARD and was involved in the European Commission 7th Framework Programme for Research and Technical Development (2007-2013). Both TOPAZ and ELIRI face problems typical for technology-based enterprises in transition economies. These are issues of inadequate

infrastructure, including metrology services, a lack of sophisticated local buyers and barriers to entry into developed markets. Both firms are part of the micro-innovation ecosystem, which includes their linkages to various R&D institutes, although these are often of an informal nature.

The links of technology-based firms with PROs is the closest a business ecosystem in Moldova comes to the traditional model of SILs from Figure 4.3. First, the joint interest in quality of training and close links through MSc and PhD programmes facilitate informal knowledge exchange. Second, technology-based firms also operate as R&D-based companies and thus can benefit from the expertize within R&D institutes. Third, these firms are also engaged in publicly funded R&D or technology transfer programmes where they participate with the PROs.

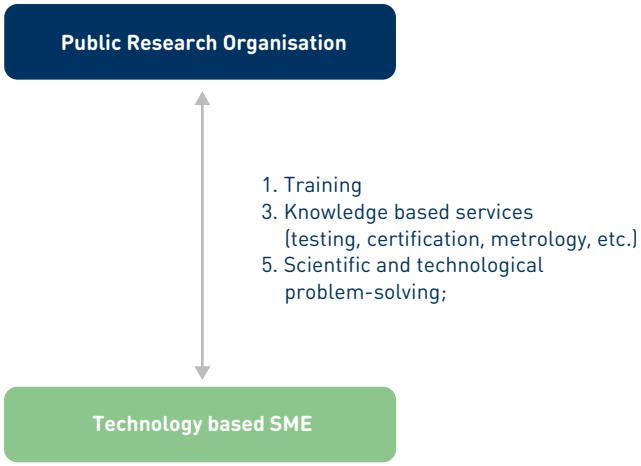
Enabling firms to access publicly funded R&D projects would strengthen SILs and promote innovation.

Going forward, however, and to strengthen the development of technology-based firms, the Government would ideally provide access for the business sector to public R&D funding calls organized by NARD *(recommendation 4.1.2)*. At the moment, firms cannot access public funds for R&D calls (except for technology transfer projects) unless they are accredited with NARD. As long as the criteria of scientific excellence are the only criteria for accreditation, this effectively closes the door for the vast majority of the business sector to participate in R&D and innovation projects with PROs. Given the market failures in R&D activities in the private sector, it is difficult to justify this policy, especially given the almost non-existent in-house R&D capabilities of firms. This would require that accreditation criteria are more centred on development, engineering and innovation management excellence.

One of the constraining factors for the long-term growth of technology-based firms in Moldova is the R&D capabilities of PROs. These organizations have not kept pace with global advances in science and technology (S&T) and are still isolated from international R&D networks. In that sense, they do not represent a push factor to promote the competitiveness and development of Moldova's technology-based firms. Furthermore,

With R&D capabilities of firms closely linked to those of PROs, restructuring the R&D sector to enhance the quality and relevance of outputs is critical.

Figure 4.12 · SILs in technology-intensive niche sectors in Moldova



Source: The UNECE, analysis by the author.

local demand for RTD is quite limited, leaving technology-based firms with international markets as their only viable market option. However, unlike IT outsourcing companies that enjoy low entry barriers to foreign markets, barriers for technology-based firms are much higher. In this respect, EU R&D programmes such as Horizon Europe help address this issue as they represent portals that allow Moldovan technology firms to integrate into EU knowledge networks. In addition, greater internationalization of local PROs and universities would directly benefit technology-based firms *(recommendation 4.2.2)*.

Knowledge-based firms in traditional industries: seizing opportunities

Technology-based firms are essential players in the innovation ecosystem of specific industries in which they operate as specialized suppliers and niche actors. Their role is potentially very significant from a technology perspective, however, their macroeconomic significance is quite limited. Conversely, knowledge-based firms in traditional industries such as agri-food, clothing and mechanical engineering are vital players in these industries' innovation systems but where their macroeconomic significance is much higher, both in terms of employment and exports.

Examples of firms performing innovation in traditional industries, such as in wine and dried fruit, show that cooperation with public R&D organizations is often limited to testing and certification services.

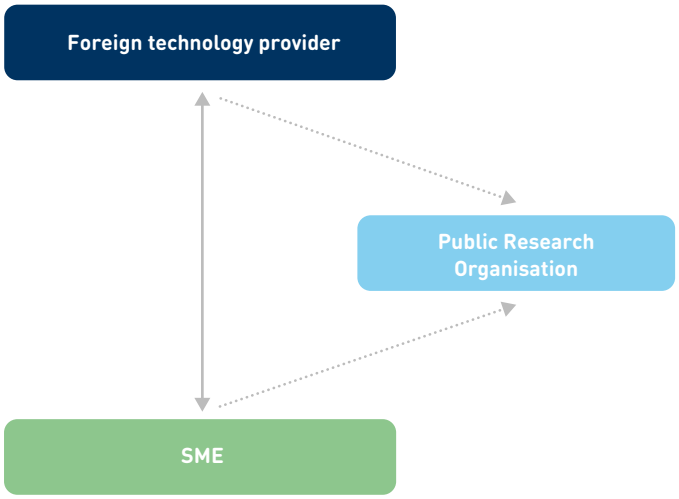
The wine industry is an excellent example of the triangle of cooperation between foreign sources of knowledge, domestic R&D organizations and local producers (Figure 4.13). This three-way interplay of cooperation has led to significant technology and process upgrading throughout the sector. A good example of the absorption of foreign technology is the use of drones in agriculture in Moldova, an advance that was introduced through a USAID project. This required foreign technology providers and cooperation with a local PRO to adapt this technology to meet local needs and ensure the system could be maintained. With many new technologies, their adoption to local settings can be complicated and requires the capacity to make the needed adjustments to suit local conditions. There are situations in traditional sectors, such as horticulture, where local knowledge in cooperation with the R&D organizations leads to new products or product differentiation. One specific example of this in Moldova is fruit leather (dried fruit paste), which was developed based on local knowledge and with assistance in certification by an R&D institute.

In all the above cases, the initial knowledge did not come from a single local source, rather, it was endogenous knowledge, i.e. the result of accumulated individual or firm-specific knowledge. Links with R&D organizations and other external entities were confined to testing and certification services[15]. However, these links are significant as they help familiarize local producers with the best foreign practices and provide them with methodological support in applying foreign knowledge.

Further innovation activity in knowledge-based firms would require closer links with R&D organizations with the latter requiring an upgrade to meet firms' needs.

It may be expected that further technologically upgrading in traditional sectors will require stronger links between local firms and domestic R&D organizations. For example, a shift from 'cut and trim' operations in clothing towards firms having their own designs will require cooperation with educational and training organizations, including digital fashion concepts. As traditional activities and products become integrated with IT features in different stages of product life cycles that stronger cooperation will be required with external 'knowledge organizations'. This leads back to the importance of restructuring the R&D sector to ensure better quality outputs and their relevance to the local economy *(recommendation 4.2.2)*.

Figure 4.13 · SILs in knowledge-intensive activities in traditional sectors



Source: The UNECE, analysis by the author.

Strengthening knowledge links in the agri-food supply chain

The agri-food sector is an important employer and exporter in Moldova (in 2019, agriculture accounted for 21 per cent of the national workforce and generated 42 per cent of total exports), the latter largely driven by low value-added products such as sunflower seeds, corn, wheat and nuts with processed food accounting for only a small share in total exports. To remain competitive, especially given the proximity of key competitors such as Ukraine or Kazakhstan in the relevant product markets, Moldova has to move up in the value chain to produce more semi-processed products. Such a move will require improving product quality, investment in product standards and certificates and building brands and supply chain partnerships. Participation in UNECE's standard-setting activities such as those undertaken by the UNECE Working Party on Agricultural Quality Standards (WP.7) and subsequent compliance with UNECE agricultural quality standards could be instrumental in this regard.

UNECE standards encourage high-quality production, improve profitability and protect consumer interests. To date, the UNECE Working Party on Agricultural Quality Standards developed more than 100 voluntary marketing standards for international trade. In additional to standards, UNECE develops relevant guidelines and explanatory materials[16].

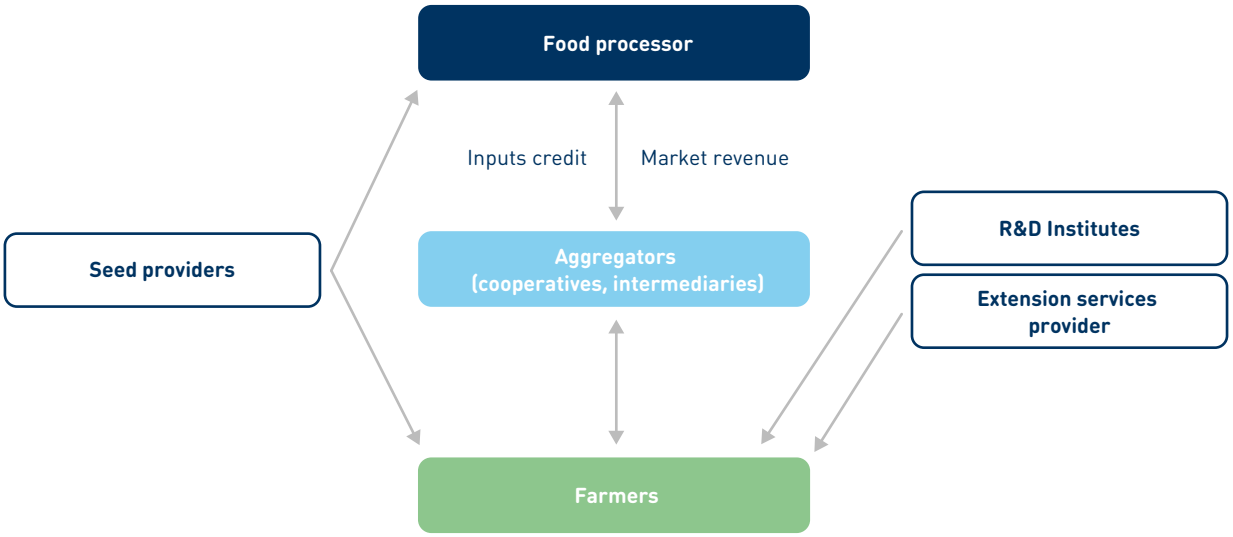
Certain products, including milk, meat and fresh cherries, are still subject to transitional periods for trade liberalization with the EU[17] and, along with other agri-products with strong potential, would benefit from enhanced productive and processing capacities. The majority of agri-food firms in Moldova are currently unable to meet the relevant export standards[18]. This makes the imperative of product and process upgrading more difficult and a situation that needs addressing quickly given the significant macroeconomic and social (employment) importance of the sector.

Upgrading to higher value-added agri-food products requires innovation and hence closer R&D collaboration with PROs, which are currently largely focused on testing facilities or extension services.

Processes involving knowledge and innovation in the agri-food sector in Moldova do not correspond to the conventional SIL model depicted earlier. In essence, agricultural innovation does not stem from organization-based research which is then diffused through extension services[19] to farmers. Instead, it takes place within a fragmented collaborative framework among food processors, farmers, producer organizations, agricultural input providers and extension-service providers (see Figure 4.14). In some cases, small producers may seek external assistance to differentiate themselves on the market while agricultural R&D institutes often operate as 'problems solvers', offering testing facilities, quality checks or ensuring good practices at the farm level by offering extension services. Irrespective of its purpose and which specific actors are involved, R&D collaboration in the agricultural sector is rarely formal and is based mainly on individual links.

Despite the fragmentation of the agri-food value chain in Moldova and the sporadic linkages between agricultural research, extension organizations, education and training institutions, several parts of the sector have, to varying degrees, invested in upgrading their own value chains and improved their coordination with other actors to capitalize on market demands. The wine, and, to some extent, fruit sectors have gradually upgraded, including through FDI and international donor support. The organic fruit and vegetable industry holds significant potential, with expanding domestic demand for such organic products and underpinned by a legal framework[20] and policies that promote organic farming. However, only 14 companies were certified to carry out processing operations of organic products in Moldova in 2020. The amount of untapped potential here becomes more apparent when one considers that these firms' combined annual turnover is less than 0.1 per cent of the food manufacturing industry's total annual turnover[21]. In terms of exports, the organic fruit and vegetable industry faces challenges due to double certification requirements by both Moldovan and EU-accredited certification bodies.

Figure 4.14 · Independent farmers' knowledge and production links



Source: The UNECE, analysis by the author.

To promote further growth in the agricultural sector, investment in rural areas by processors at the intermediate stages of the value chain may be particularly beneficial as this would add value to agricultural products while simultaneously connecting farmers with urban demand. This then has other flow-on benefits, such as generating off-farm employment and contributing to the nutritional quality and safety f locally grown food.

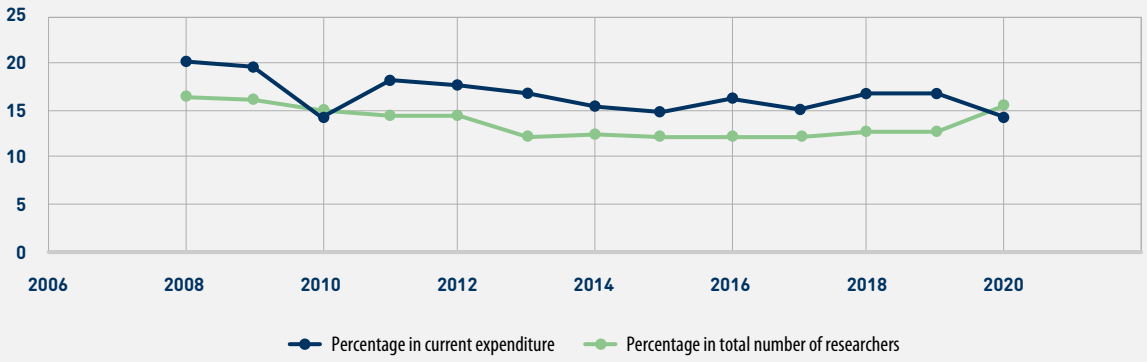
Development of extension services in agriculture that connect the private sector to research could support agri-food sector upgrading.

Box 4.1 R&D in Moldova's agricultural sector

In Moldova, the funding of agricultural research is competition-based and overseen by NARD and, since 2020, approximately 12 per cent of NARD's total funding has been allocated to agricultural research projects. The Institute of Horticulture and Food Technologies has received funding for the largest number of projects (39 per cent of funding allocated to agriculture), followed by the State Agrarian University of Moldova (21 per cent of funding allocated to agriculture)[a]. In addition, under the fund for Technological Transfer Projects, four projects were financed in 2019-2020 for an amount totalling 13.8 million Moldovan Leu (approximately €643,700).

When looking at the Moldovan budget for R&D activities, agricultural sciences rank third, with most funding directed towards applied research, leaving almost no expenditure for agricultural technology development. Despite an increase in the number of researchers in agriculture sciences in 2020, the overall trend in agricultural R&D spending remains negative, primarily aggravated by a decrease in the national-budget allocations (Figure 1).

Box-figure 4.1 · Agricultural sciences share in current R&D expenditures and the total number of researchers (Per cent)



Source: The UNECE, based on the data from the National Bureau of Statistics of Moldova.

The impact of R&D in agriculture is highly dependent on the availability of complementary inputs from sources such as rural infrastructure, insurance providers, capital markets, extension services and farmers[b]. Many of these complementary inputs are lacking in Moldova. For example, despite their relevance to the needs and coverage of rural areas, extension services operate in isolation from the sector as there are only a few institutional linkages between agricultural research, extension organizations and education and training institutions.

The poor levels of cooperation between agribusinesses and research institutes can be attributed to several factors, such as the lack of demand for innovation from the sector, limited domestic research capabilities, low absorption levels of new agricultural techniques, the lack of a culture of collaboration and weaknesses in the business enabling environment. Furthermore, the long timeframe to get a return on investment for R&D spending is generally unattractive to businesses while the research community lacks incentives to promote linkages with enterprises, with the evaluation and awarding practices of researchers relying mainly on scientific publishing. Exceptions in this regard do exist, such as the Institute of Genetics, Physiology and Plant Protection where SMEs represent up to 70 per cent of its client portfolio. Another example is the InnoCenter, which mainly works on projects initiated by local SMEs and these projects are complemented by the efforts of civil society and international donors in specific agri-food value chains (e.g. technologically upgrading wine, sugar, berries and other horticultural produce as well as some value chains involving organic products).

Source: The UNECE, based on Ilie, E. (2021) *Exploring sources of technological upgrading in Moldova's agri-food sector*.

[a] See information provided by the NARD at https://ancd.gov.md/sites/default/files/document/attachments/Rezumate%20proiecte%20site.pdf

[b] Fuglie, K., Gautam, M., Goyal, A. and Maloney, W. (2019), *Technology and Productivity Growth in Agriculture*, World Bank, Washington D.C.

Policymakers could seek the further development of extension services in agriculture that connect the private sector to existing or potential research and innovation programmes. In parallel, Masters and PhD programmes could be initiated by academia in collaboration with industry while incentives are offered for the R&D sector to engage more with the private sector. Going forward, facilitating the creation of links between the R&D sector and food processors, extension service providers and aggregators could help to gradually move towards higher value-added activities which would improve the sector's global competitiveness.

R&D commercially driven SILs vs problem-solving linkages

An examination of five specific business ecosystems in Moldova detailed in Table 4.1 revealed that their knowledge linkages showed no signs of a conventional SIL model in any of them. In other words, assuming that there is a portfolio of R&D results that are 'ready-made' for implementation would seem to be quite unrealistic.

SILs in Moldova are "problem-oriented" with companies coming to public R&D organizations, universities or other institutions seeking solutions to identified challenges.

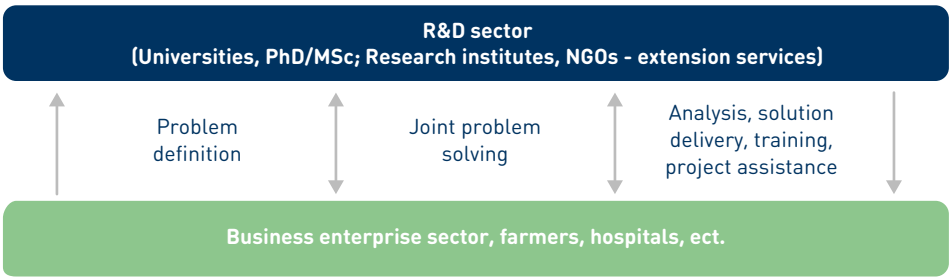
However, it would also be wrong to assume that SILs do not exist in Moldova. Evidence from interviews suggests that such linkages exist but in a non-conventional form. Although diverse, the knowledge links in the five business ecosystems mentioned in the previous section share a common feature regarding SILs – they are all essentially problem-oriented. Problems in this context are the operational, engineering and innovation challenges confronting successful enterprises or other organizations that prompt them to seek solutions from local universities, R&D organizations or non-government organizations (NGOs), such as extension services providers in agriculture. For example, this is the case for a foreign company wanting to optimize its stocks or improve its cybersecurity system which leads it to engage IT departments and their MSc or PhD students to devise workable solutions. Or, in the health system, University PhDs develop protocols for the treatment of neurological diseases. Or yet in another sector - agriculture, farmers faced with the severe issue of soil erosion request training seminars on prevention of soil depletion.

Stimulating demand for innovation through increased access to RTD services in the private sector would help to strengthen SILs in terms of enhanced relevance and benefits gained from public R&D investment.

One way to enhance these links and facilitate problem-solving in the business sector while stimulating the demand for R&D would be to introduce innovation vouchers *(recommendation 4.1.3)*. Such vouchers cover a share of total service costs (typically 60 per cent), with eligible service providers including PROs and other institutions accredited to perform R&D (including private ones). An excellent example of this type of initiative is the Serbian programme of innovation vouchers which includes a number of elements, such as developing new or improving existing products (related to function and quality), processes and services. Furthermore, the Serbian programme also provides support to enable proof of concept, conduct feasibility studies, produce laboratory prototypes, validate new or improved products, processes and services, innovate advisory services and so forth. In Moldova's case, to bridge the gap between the R&D and business sectors that hinders more conventional types of SILs from developing, business sector representatives could be invited to sit on the NARD supervisory board *(recommendation 4.1.1)*. The presence of business-sector representatives allows them to influence funding policy and highlight how the R&D sector could be restructured to have greater local relevance.

Figure 4.15 presents, in stylized form, the key feature of these problem-oriented or demand-driven linkages. They start with the users defining the problem to 'knowledge providers' that are perceived to have the required expertize. This relationship can range from testing and other metrology services to searches for a solution through small joint projects.

Figure 4.15 · SILs in Moldova



Source: The UNECE, analysis by the author.

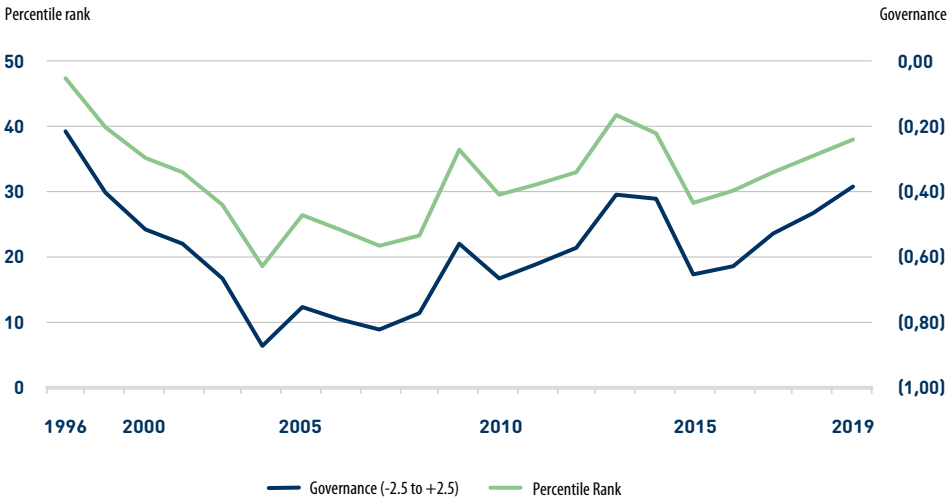
In most cases, the relationship can be characterized as joint-problem solving rather than the delivery of off-the-shelf R&D solutions from providers.

Many of these SILs are implemented through MSc or PhD dissertations or internship projects. Irrespective of the details, they all represent a response to a specific problem and are often short-term interactions, even when the participants personally know each other and have cooperated repeatedly before.

'Pockets of Excellence': co-creation policy processes and their facilitating potential

The previously described successes in segments of the IT and agricultural sectors as well as in attracting FDI to several FEZs were not primarily driven by public policy activities so much as by organizations who were able to initiate collective action among dispersed and disorganized stakeholders. Such instances of successful collective action have often resulted in so-called 'pockets of excellence'.

Figure 4.16 · Index of Moldova's governmental effectiveness 1996–2019



Source: The UNECE, based on Moldova's State Agency on Intellectual Property (AGEPI) http://www.db.agepi.md/Inventions/panorama/1.

Upscaling existing sources of growth will require significant improvement in public sector capabilities.

Innovation policy in Moldova should build on these 'pockets of excellence' and try to facilitate further upscaling of existing successful business ecosystems while promoting the emergence of new ones. However, such development faces a few obstacles, including the low policy capabilities of the Government, Moldova's systemically dispersed and disorganized stakeholders as well as the challenges to design in detail and implement such upscaling. Currently, Moldova's governmental effectiveness is somewhat limited, ranking only slightly above the average for the lower-middle-income group to which it belongs (38 per cent compared to the 34 per cent average for the group)[22], although it must be noted that the situation has improved since 2015[23].

Building on sectoral 'pockets of excellence' to develop business ecosystems

International donor organizations have been instrumental in nurturing pockets of excellence.

When considering policies facilitating the emergence of business ecosystems to improve and foster effective SILs, it may be helpful to focus first on the entrepreneurial actors within the ecosystem[24]. In the case of Moldova, international donors have been contributing significantly to support such actors who have emerged within 'pockets of excellence'. Based on the fact-finding undertaken as a part of the review for this text, several of such 'pockets of excellence' have been identified and are presented in the non-exhaustive list below.

Box 4.2 'Pockets of excellence' in Moldova

- The Moldovan Association of ICT Companies and the Tekwill project emerged as significant players who have shaped the IT services ecosystem of Moldova. The government decision to support the Moldova IT Park also played a very important role in the uptake of the IT sector in Moldova, but equally, ATIC and Tekwill have emerged as visible contributors to the technological upgrading and innovation activities recently seen in IT services.
- The Balti FEZ has emerged as potentially the most notable success story among Moldova's six FEZs and is now responsible for 9 per cent of the country's exports in terms of value. Moreover, its cooperation with the Alecu Russo State University, the Moldovan Chamber of Commerce and Industry, the German Corporation for International Cooperation (GIZ) and companies within the FEZ, have led to a local dual vocational training programme which is planned to expand to the MSc programme in mechanical engineering and technology management.
- Assisted by USAID, wine producers have reorganized the sector and have upgraded their processes and products. The fruits producer's association – MoldovaFruct – is a major player assisting its members in technologically upgrading their operations and facilitating market access.
- Several support organizations, including NGOs, are also present 'pockets of excellence'. Thus, the Organization for SME Sector Development, assisted by international donors, has evolved into a professional organization that can deliver effective, high-quality support to SMEs. Furthermore, the Moldovan Chamber of Commerce and Industry (CCI) has also become a critical intermediator and facilitator in the economy through various projects and activities that range from assisting firms in accessing foreign markets to supporting dual education. Finally, InnoCenter, which is attached to the local university in Gagauzia, has developed sufficient capacity to operate as a successful intermediator in the growth of local companies[a].

Source: The UNECE based on https://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/frontpage/index.html
[a] http://www.inno-center.md/

Going forward, innovation policy should recognize these local 'pockets of excellence' and their role as entrepreneurial connectors within their various ecosystems. Therefore, the Government would ideally aim to assist such actors by removing obstacles in the entrepreneurial environment and facilitating their access to funds, including funds provided by international donors. Foreign sources of finance have long been important to support 'pockets of excellence' as they provide a key resource in the initial stages of development that local actors could not provide. Initiating collective action[25] and addressing numerous market, system and capability failures has always been a challenge and remains so now.

Removing obstacles in the entrepreneurial environment and facilitating access to finance would be crucial to support upgrading of "pockets of excellence".

Interestingly, Moldovan 'pockets of excellence' have public objectives but operate based on private sector implementation principles. Successful implementers operate on a project-by-project basis and have clear milestones and measurable objectives. They are exempt from many of the rules and constraints of the public sector entities in both the way they operate and how they reward their staff. This is of great benefit as it provides the needed flexibility and swiftness in their operations that allow them to excel. This freedom from constraint also generates a positive cycle in terms of expected outputs and outcomes that justify ongoing investment out to at least the medium term.

While nurturing 'pockets of excellence' and policy co-creation has already yielded positive outcomes in terms of SILs, it is first and foremost hampered by the limited capabilities of PROs and the restricted absorptive and innovation capabilities of the private sector and other organizations. Hence, supporting linkages between universities and R&D institutes with limited research capacities on the one hand and enterprises characterized by weak absorptive capacities on the other is insufficient to deliver strengthened and more effective SILs. Creating organizations and entities such as innovation centres, IT parks and incubators is necessary but again, insufficient by itself to have the desired broad economic impact. Thus, an essential component of SIL policy would be policies addressing the restructuring of public R&D and aimed at enhancing technology capabilities in the private sector.

Enhancing PROs' capabilities as well as the absorptive and innovative capabilities of business is essential for 'pockets of excellence' to produce positive spill overs for the broader economy.

Policy Recommendations

The below recommendations are structured based on how they address R&D demand, supply services and linkages between them. Addressing the SIL capabilities and readiness of R&D organizations and those that use their results is as crucial as addressing the linkages themselves. The specifics of the three helices of SILs in Moldova have also been taken into account when making these recommendations. When it comes to the time frames associated with each recommendation, short term measures will require prompt action by existing organizations, however, the reality of budgetary constraints has been factored in when making these recommendations. The medium- to long-term measures require substantial organizational and institutional change, incur more substantial financial costs and require the preparation, consensus and mobilization of many stakeholders.

Table 4.2 Summary of policy recommendations on SILs and technology commercialization

Recommendation 4.1: Strengthen **the demand side of SILs** through targeted assistance mechanisms to increase access to and uptake of RTD services in the private sector to **enhance the relevance and impact of public R&D investment.**

As most R&D funding comes from Government through State programmes, there is little systematic alignment with private sector needs or commercialization of research results. For this reason, public R&D programmes should be reformed to support both internationally excellent and locally relevant R&D with substantial involvement of demand-side actors to both funding and undertake R&D to promote linkages and ensure public funding has a catalytic effect and creates value systematically. Access to foreign supplier networks and local demand for RTD should be stimulated through targeted mechanisms.

Actions	Priority	Time-frame	Roles
4.1.1. **Include private sector representatives in the NARD Supervisory Board.**	②	Short-term	The Government and NARD
4.1.2. **Enable wider private sector access to R&D funding,** including by facilitating private sector participation in R&D grant calls organized by NARD using clear and transparent criteria for firms to participate.	①	Medium-term	The Government and NARD
4.1.3. **Introduce innovation vouchers** providing State subsidies to defray the costs of innovation providers' services **to facilitate and stimulate demand for R&D in the private sector as well as entrepreneurship based on research results.**	①	Short-term	The MoE and ODIMM
4.1.4. **Enlarge the supplier development programme** administered by ODIMM **to enhance the private sector's absorptive capacity.**	②	Medium-term	The MoE and ODIMM

Recommendation 4.2: Strengthen **the supply side of SILs** by increasing funding for R&D and ensuring an **inflow of young researchers** within the comprehensively reformed R&D sector.

The current level of public R&D funding is insufficient to drive innovation-led development. While increasing funding is imperative, it is equally important to ensure that financial resources are used efficiently and play a catalytic role. For this reason, increases should be accompanied by a significant restructuring of the R&D sector.

Actions	Priority	Time-frame	Roles
4.2.1. **Renew the young researcher support programme** as a part of an overall increase in the public R&D budget to ensure the inflow of young staff into PROs and make careers in research more attractive for young Moldovans.	①	Short-term	The MER
4.2.2. **Gradually restructure PROs** to enhance the quality and impact of their outputs, ensure they are competitive and commercially relevant while simultaneously promoting international linkages.	①	Medium-term	The MER
4.2.3. **Differentiate universities as either research-based or vocational-education based** as a means to enhance the quality of education and facilitate linkages with international R&D centres of excellence.	②	Long-term	The MER

Recommendation 4.3: Enhance **linkages between PROs and the private sector**, including companies attracting foreign investment, by aligning private sector needs and commercialization potential with public R&D funding **upgrade the IT sector**, an existing 'pocket of excellence', through closer links with higher education.

Limited business cooperation with local R&D organizations and FDI that is not connected with potential local suppliers should be addressed through dedicated policy tools. The IT sector, if it is to continue its growth, needs to develop closer links with foreign higher-education institutions to promote knowledge and technology exchange and to remain competitive.

Actions	Priority	Time-frame	Roles
4.3.1. **Extend NARD technology transfer projects** significantly to incentivize closer links between PROs and the private sector as a part of an overall increase in the public R&D budget.	①	Short-term	The Government and NARD
4.3.2. **Build the capacity of the Invest Moldova Agency to more effectively attract FDI** by integrating a project-based approach in its operations (i.e. performance-based contracts with an evaluation system based on key performance indicators, potentially with international donor support).	②	Medium-term	The Government, MoE and FEZs

/...

Table 4.2 Summary of policy recommendations on SILs and technology commercialization (Concluded)

Actions	Priority	Time-frame	Roles
4.3.3. **Enhance linkages between the FEZs and the rest of the economy,** supporting the skills development and technology upgrading initiatives operating in the FEZs.	②	Medium-term	The FEZs and MoE
4.3.4. **Introduce mechanisms to link the IT sector with higher-education institutions** to help firms transition to higher value-added activities while simultaneously enhancing local IT education and developing R&D linkages with international centres of excellence.	①	Long-term	The MoE and MER

Source: UNECE.

Notes

1 Eduardo Albuquerque, Wilson Suzigan, Glenda Kruss, Keun Lee (eds)(2015) Developing National Systems of Innovation: University–Industry Interactions in the Global South, Edward Elgar, Cheltenham.

2 https://unctad.org/webflyer/investment-policy-review-republic-moldova

3 Idem

4 The Fraunhofer-Gesellschaft is the leading organization for applied research in Europe, based in Munich and with the pool of 75 institutes and research institutions at locations throughout Germany. It has developed international collaboration with research partners and companies from around the world connecting directly to regions that drive scientific progress and economic development. For more, see here https://www.fraunhofer.de/en/about-fraunhofer/profile-structure.html

5 This should be partly attributed to the structural features of the Moldovan economy in which the share of manufacturing is only 23per cent which is behind the usual share of over 30 per cent in Central European economies, including Romania. Also, food processing and labour-intensive sectors dominate while R&D based manufacturing is rarely present.

6 http://www.webometrics.info The Ranking Web correlates highly with other rankings, especially those based on research results. It has a far larger sample size and scope than many other ranking systems as it includes more than 20 000 universities worldwide and also it takes into consideration various university missions (not only research).

7 IDC (2015) Moldova Moving into the Premier League of IT Nearshoring, An IDC Study, Sponsored by USAID and GIZ

8 World Trade Organization Database https://timeseries.wto.org/, Trade in commercial services

9 World Bank (2017) The Performance of Free Economic Zones in Moldova, MOLDOVA TRADE STUDY, Note 4, The World Bank https://openknowledge.worldbank.org/handle/10986/2194

10 (ibid)

11 For example, according to the UNCTAD World Investment Report 2019, the development of an entirely new type of special economic zone - the SDG model zone could help attract investment in SDG-relevant activities, adopt the highest levels of environmental, social and governance standards and compliance, and promote inclusive growth through linkages and spill-overs.

12 UNCTAD, World Investment Report, 2019 https://unctad.org/webflyer/world-investment-report-2019

13 UNCTAD, World Investment Report, 2019 https://unctad.org/system/files/official-document/WIR2019_Key_Messages.pdf

14 https://www.czechinvest.org/en

15 An example of such an organization is CenterLab, a central testing laboratory of alcoholic and non-alcoholic beverages as well as canned products. See https://lctbanpc.md/en/

16 UNECE, Working Party on Agricultural Quality Standards (WP.7), Brochures and Publications: https://unece.org/trade/wp7/brochures-and-publications

17 As noted by the UNECE in Regulatory and Procedural Barriers to Trade in the Republic of Moldova, 2016, p 110 https://unece.org/fileadmin/DAM/trade/Publications/ECE_TRADE_433E.pdf

18 Ilie, E. (2021) Exploring sources of technological upgrading in Moldova's agri-food sector.

19 An agricultural extension service offers technical advice on agriculture to farmers and supplies them with the necessary inputs and services to support agricultural production. It provides information to farmers and passes to the farmers new ideas developed by agricultural researchers. Agricultural extension programmes cover a broad area including improved crop varieties, better livestock control and improved water management as well as the control of weeds, pests and plant diseases. FAO https://www.fao.org/3/t0060e/T0060E03.htm

20 For example, see Law No. 115 of 9 June 2005 on organic agri-food production; Government Decision No. 884 of 22 October 2014 on approving the Regulation on the use of the national mark "Agricultura Ecologică - Republica Moldova".

21 Ekoconnect, Report on the Status of Organic Agriculture and Industry in Moldova, 2020

22 Percentile rank indicates the percentage of countries worldwide that rate below the selected country. This indicates that 38 per cent of the countries rate lower than Moldova and 62 per cent rate higher than Moldova.

23 World Bank Governance Database http://info.worldbank.org/governance/wgi/#home

24 Colin Mason and Ross Brown (2014) *Entrepreneurial Ecosystems And Growth Oriented Entrepreneurship*, Background paper prepared for the workshop organized by the OECD LEED Programme and the Dutch Ministry of Economic Affairs on Entrepreneurial Ecosystems and Growth Oriented Entrepreneurship The Hague, 4

25 https://en.wikipedia.org/wiki/Collective_action_problem

Chapter 5

DEVELOPING INNOVATION AND TECHNOLOGY TRANSFER INFRASTRUCTURE IN MOLDOVA

Main messages

- Moldova's innovation and technology transfer infrastructure, both physical and virtual, is relatively new but encouragingly diverse in function and form, including various types of support mechanisms from industrial parks to fabrication laboratories (Fablabs). However, the linkages between these diverse infrastructure components need substantial improvement to ensure they work together efficiently.
- Traditional technology transfer (TT) infrastructure is still under-developed in Moldova and most technology transfer offices (TTOs) do not operate effectively enough to adequately fulfill their given roles. This is largely attributable to both the lack of TT infrastructure and an overall lack of skilled personnel to effectively engage in knowledge transfer (KT) tasks.
- Effective technology transfers in Moldova require enhancing the linkages between TT infrastructure components, addressing bottlenecks in TT legislation, facilitating the creation of viable innovation hubs at the sub-national level and establishing TTOs able to provide feasible pipelines for TT projects.
- With its rich innovation support infrastructure, innovation activities are currently concentrated in and around the capital. Nation-wide development must have adequate and locally relevant regional infrastructure to close the rural-urban gap in innovation and address regional socio-economic challenges (e.g. through infrastructure specialization based on priority areas under smart specialization).

Recommendations at a glance: Developing innovation and technology transfer infrastructure

Recommendation 5.1: Optimize the regulatory environment to address current shortcomings and barriers to developing innovation infrastructure and introducing new products, services and processes to the market.

Actions	Priority	Time-frame	Roles
5.1.1. Review the current law on scientific and technological parks and innovation incubators to better stimulate demand and boost the project pipeline.	①	Short-term	The Government of Moldova, initiated by the Ministry of Education and Research (MER)
5.1.2. Remove product-certification barriers to eliminate excessive costs associated with double certification.	②	Short-term	Relevant agency, initiative by the MER and MAFI
5.1.3. Improve the procurement and import practices of specialized equipment for testing.	③	Short-term	The MER, MAFI, MoE

Recommendation 5.2: Develop sector-specific TT and innovation infrastructure, linking it to national development priorities and Smart Specialization efforts.

Actions	Priority	Time-frame	Roles
5.2.1. Link innovation and TT infrastructure more closely to priority sectors identified under Smart Specialization efforts.	①	Long-term	The MER, NARD, Ministry of the Economy (MoE) and Organization for Development of Small and Medium-sized Enterprises (ODIMM)
5.2.2. Encourage linkages with international actors engaged in similar TT activities and using similar innovation infrastructure abroad.	③	Medium-term	The MER, NARD and MoE
5.2.3. Develop sector-specific advisory services to encourage innovation in priority fields.	②	Medium-term	The MER and NARD

Recommendation 5.3: Support research commercialization through a national TTO and build knowledge transfer (KT) skills at each public research organization (PRO).

Actions	Priority	Time-frame	Roles
5.3.1. Establish a national TTO.	①	Short-term	The MER, NARD, PROs and higher educational institutions (HEIs)
5.3.2. Require PROs to establish a clear intellectual property (IP) policy and a Memorandum of Understanding (MoU) or similar with the national TTO.	①	Short-term	The MER, NARD, PROs and HEIs
5.3.3. Require each PRO to designate an internal partner to ensure effective communication and TT.	②	Short-term	The MER, NARD, PROs and HEIs
5.3.4. Set clear joint key performance indicators (KPIs) for both the TTO and PROs.	①	Medium-term	The MER, NARD, PROs and HEIs

/...

Recommendation 5.4: Adopt a clear regional focus for innovation and TT infrastructure.			
Actions	**Priority**	**Time-frame**	**Roles**
5.4.1. Establish a mechanism to enable funding for local physical and virtual innovation infrastructure.	②	Medium-term	The MER, Ministry of Infrastructure and Regional Development (MIRD)
5.4.2. Undertake regional Strengths, Weaknesses, Opportunities, and Threats (SWOTs) and needs analyses to design customized local support.	①	Short-term	The MER, NARD and MIRD
5.4.3. Establish stakeholder groups willing to implement actions, including via co-funding for physical infrastructure.	③	Medium-term	The MER, NARD and MIRD
5.4.4. Pilot actions and refine programmes on TT to ensure they meet existing needs and yield the intended results.	②	Medium-term	The MER, NARD and MIRD

Source: The UNECE.

Enhancing innovation and technology transfer infrastructure is an essential component of policy efforts to spur innovative development in Moldova

Despite a relatively solid overall performance in the Global Innovation Index 2019 (see Chapter 2 for details) regarding its innovation outputs, Moldova still struggles to translate its technological research findings into real-world products and services as the declining number of International Standards Organization (ISO) certificates shows. The findings of the pilot UNECE Innovation Policy Outlook highlighted that innovation and technology commercialization processes in the country are already insufficiently supported, a situation that is being compounded by decreasing public sector investment in R&D and low levels of private-sector R&D expenditures. In addition, foreign direct investment (FDI) that has the potential to support foreign innovation and technology transfer, generate positive spill-overs domestically, build skills and new market niches, is largely absent from the Moldovan developmental landscape.

Addressing declining R&D investments, attracting the right type of FDI and enhancing private sector absorptive capacities is important to nurture economic diversification and enhanced business sophistication through innovation in Moldova. Confronting these issues needs to be done in partnership with an ecosystem of institutions that can effectively and systematically transform the innovative ideas and concepts of researchers and academia into marketable products and services through TT. Innovation and TT institutions could play a catalysing role in the innovative development of the Moldovan economy by assisting in the commercialization of innovation and addressing long-term regional development challenges. This institutional ecosystem would ideally include actors such as TTOs, scientific-technological parks (STPs) as well as public and private innovation centres.

Improving the technology transfer infrastructure is crucial for the results of innovative research producing the catalysing effect on the economy and tackling sustainable development challenges.

The Government of Moldova has already recognized the importance of innovation as a driver of sustainable economic development and growth throughout the country and, as such, enhancing innovation and TT is on the Government's policy agenda. In this regard, improving Moldova's TT infrastructure is key to ensuring that the results of innovative research fulfil their ultimate purpose, namely addressing economic and social challenges with positive spill-over effects that benefit all segments of Moldovan society.

Technology transfer institutions, if properly set up, are ideally suited to engage in experimentation and learning that can have catalytic effects on the commercialization of innovative advances.

Defining technology transfer and innovation infrastructure

TT infrastructure is critical to support the creation, storage, sharing and transformation of knowledge and thus the promotion of innovation.

There is no single commonly accepted definition of innovation infrastructure. The United States National Institute of Standards and Technology (NIST) notes that innovation infrastructure is a crucial element of a nation's capacity to innovate and includes various elements, such as the public education system, public investment in R&D, worker training and retraining as well as incentives to foster private sector investment in R&D (e.g. reduced taxes, innovation vouchers, etc.). The Innovation Policy Platform[1] focuses more strongly on infrastructure for TT from research institutions to the commercial sector, noting that infrastructure is a *"part of [the] enabling conditions for technology transfer and commercialisation that provides the physical and virtual habitats of knowledge"*. The organization also highlights that TT infrastructure has critical importance for the creation, storage, sharing and transformation of knowledge by facilitating its connectivity to real-world applications while keeping transaction costs low, all of which are prerequisites to efficiently utilize new knowledge.

The depiction of existing innovation and TT infrastructure, as discussed in Box 5.1 below, should be complemented by an analysis of its functionality. Thus, mapping of the infrastructure by type is a useful starting point to assess the effectiveness of the infrastructure and to identify and address existing gaps.

The level of interconnectedness of the TT infrastructure components defines the efficiency of the system as a whole.

The provision of TT infrastructure may be directly linked to policy action, for example, the establishment of publicly funded Science and Technology Parks (STP) and TTOs. Alternately, such action could target the core activities of the participants themselves by promoting networking among researchers, entrepreneurs, investors, knowledge brokers and so forth. When it comes to TT and innovation infrastructure, the individual physical and virtual components are not particularly functional by themselves, however, when these components are correctly balanced and connected they form an operational network that serves to drive innovation forward. Thus, the degree to which the different components of TT infrastructure are linked determines the efficiency and, accordingly, the benefits derived from such infrastructure. Ensuring a high degree of efficiency is of particular interest and importance in the Moldovan context given the limited funds available to improve existing TT and innovation infrastructure. This is an issue made even more salient in the aftermath of the COVID-19 pandemic.

The legislative framework for TT and innovation infrastructure is in place but provides insufficient incentives for TT while internal institutional regulations to facilitate classical TT[2] are largely absent

Existing innovation infrastructure in Moldova is currently regulated by 5 main laws with no provisions to facilitate classical TT. These include the Code of the Republic of Moldova on Science and Innovations, the law on free economic zones (FEZ), the law on industrial parks and the law on scientific and technological parks and innovation incubators. The demonstrated benefits of the financial regime at the FEZs arguably opened the door to the adoption of the Law on Information Technology Parks which, in turn, allowed the establishment of the Moldova IT park (see Chapter 4).

Box 5.1 Types of physical and virtual innovation support infrastructure

Supporting infrastructure can be divided into two main types: physical and virtual.

1. Physical infrastructure refers to the tangible facilities, tools and scientific instrumentation used by scientific and technological communities to carry out research as well as the localities offered to host spin-off companies and all other organizations involved in the process.

   Common types of physical infrastructure include:

   - TTOs to disseminate and commercialize technology as well as absorb and adapt technology from elsewhere;
   - Industrial liaison offices to develop research-industry cooperation;
   - Proof of concept centres to theoretically verify that new products and services will function as intended;
   - Prototype development support to demonstrate that new products and services will function;
   - Market and competitor intelligence surveillance facilities to assess the market potential of commercialized technologies;
   - Incubators to grow early-stage businesses;
   - Scale-up centres for industrial production testing;
   - Venture accelerators to accelerate business growth;
   - Science and technology parks (also called 'technoparks');
   - Investment funds (seed and later-stage capital) to support business development;
   - IP laws, regulations and practices which support technology commercialization;
   - Multifunctional industrial platforms offering a diversity of physical facilities;
   - Funding for TT and innovation, for example, from a national innovation fund.

2. Virtual TT infrastructure refers to the personal contacts, networks, knowledge intermediaries and brokers used by the various actors engaged in innovative activities.

   - Personal contacts and networks, such as individual working relationships involving researchers in business, universities and PROs. These can be effective starting points for licensing and joint R&D contracts between universities and businesses, with the potential to formalize research results through TTOs.

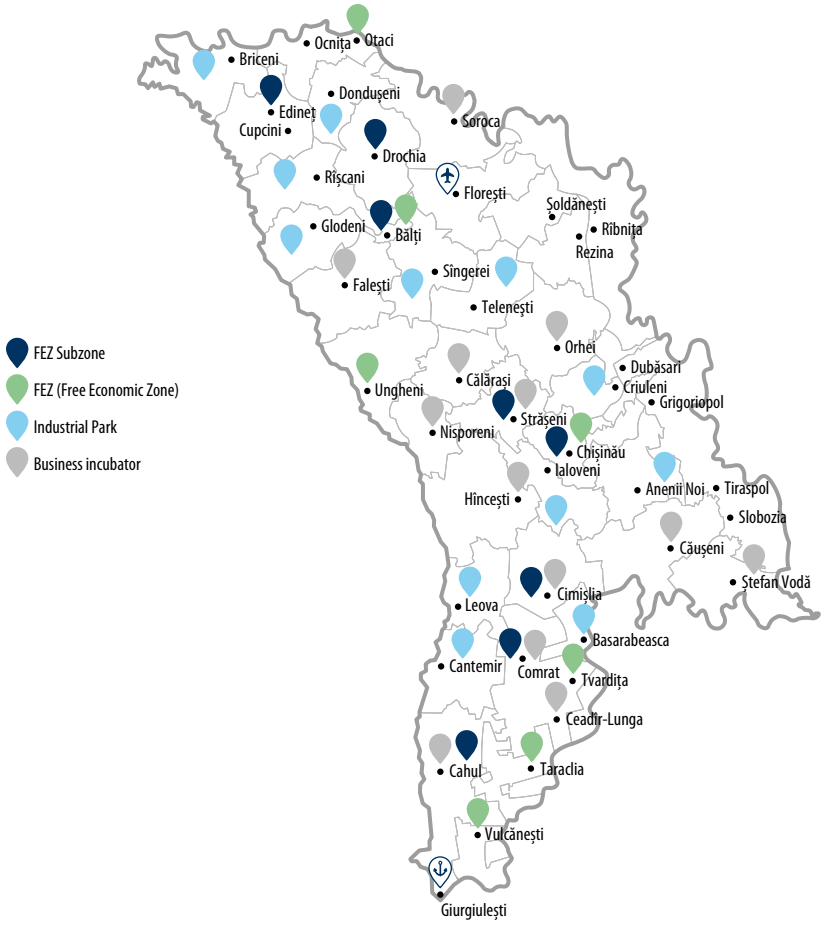
Source: The UNECE based on https://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/frontpage/index.html

Industrial Parks have fewer tax incentives and no tax or other fiscal incentives are currently provided for the residents of either scientific and technological parks or innovation incubators. The latter have rather limited activity in Moldova and it has been suggested that they need policy improvements to stimulate their activity[3].

Mapping the existing and planned technology transfer and innovation infrastructure revealed potential capabilities

TT infrastructure, both physical and virtual, to support enterprise innovation in Moldova is relatively new and encouragingly diverse given that it includes FEZs, industrial parks, clusters, scientific and technological parks and business incubators. As shown by the map in Figure 5.1, this infrastructure is reasonably distributed across the country, although with strong concentrations in and around Chisinau and the main cities of Balti, Cahul and Comrat. It is continuing to evolve under new policy actions with notable new activities including 12 multi-functional platforms (under development), 3 centres for innovation and TT as well as regional initiatives such as Start-up City Cahul.

Figure 5.1 · The map of Moldova's physical innovation and TT infrastructure



Source: The UNECE, based on the data from the MoE of Moldova.

The main existing platforms, or types of platforms, that support innovation are:

1. Free Economic Zones
2. Industrial Parks
3. Tekwill
4. A virtual IT Park (Moldova IT Park).
5. ODIMM
6. Business incubators
7. Clusters

The most successful existing platforms are acknowledged to be the FEZs and the Moldova IT Park; these offer very concrete fiscal and operational facilities. ODIMM is also well-recognized for effectively providing SMEs with grant schemes, knowledge and educational support.

Infrastructure that has been established by law but where activity is less visible includes:

8. Scientific-technological parks and innovation incubators – these fall under the legal responsibility of the National Agency for Research and Development (NARD).

Planned and only recently established infrastructure includes:

9. Multi-functional platforms

10. Innovation and TT centres

11. Start-Up City Cahul.

12. Prototyping support

Other supporting innovation infrastructure that is normally part of a healthy ecosystem and that has been mapped for this report includes:

13. Accelerators and start-up support

14. Government grants for research and development and innovation (R&D&I)

15. Venture Funding

This section will present in more detail each of these infrastructure elements, preparing the ground for an assessment of the infrastructure as a whole in subsequent sections.

Free economic zones

Since the relevant law was passed in 2001, Moldova has established seven free economic zones and 24 sub-zones that offer tax and customs benefits to their residents[4]. This was done to help achieve the country's goal of accelerating socioeconomic development by stimulating entrepreneurial activity.

At the request of FEZ Balti, the MoE adopted and put in place an ongoing programme to connect local SMEs to the supply chains of the resident transnational automotive corporations. This programme can directly contribute to the innovativeness of local SMEs and thus help meet the objectives of sustainable and socio-economic development.

Industrial parks[5]

Industrial parks were designed to facilitate industrial development at the local level, allowing small, medium and even large companies to secure a number of advantages that included access to modern infrastructure and research facilities, cost savings on fixed asset investments, access to a skilled labour market, research facilities and other inputs. Moldova has established 10 industrial parks since 2013 and, in 2017, the MoE reported that 60 industrial companies were operating in these parks, employing 2714 people[6].

Tekwill

Tekwill was created in 2017 as the centre of excellence for the information and communications technology (ICT) sector in Moldova with the main goal of aligning the field with the requirements of the 21st century. To continue to increase the competitiveness of the IT industry and other strategic economic sectors the centre has expanded its original fields of activity becoming, in 2019, a complex national-level project.

The Tekwill model now serves as a template for other sites, including ATU Gagauzia, a planned centre of excellence for IT in Comrat[7].

In line with the comments below on the Moldova IT Park, it is recommended that the Tekwill model and platform be considered for application to other priority sectors.

However, to ensure that the model can be successfully applied to several diverse economic sectors, it will be necessary to analyse the model's functions and practices to determine if they are transferable 'good practice' or are specific to just the IT sector.

Moldova IT Park

The Moldova IT Park was created in 2017 and is a unique virtual structure that operates through a multi-stakeholder governance model. It seeks to increase the regional competitiveness of the Moldovan IT sector, in part by offering an across-the-board tax rate of 7 per cent on the sales revenue of all the 'residents', which significantly reduces the tax burden of these companies.

According to the most recently available annual report[8], the total number of registered 'residents' at the end of 2019 was 567 companies, with 525 of them classed as 'active residents'. The latter number represented a 55.3 per cent increase since the end of 2018 and the most recent figures indicate that, at the time of writing, the park has 768 active residents.

The success of the Moldova IT Park suggests that this model should also be examined for its suitability to be applied to other sectors of the economy. However, such an examination should take into account budgetary implications, as well as the complexities of application to other sectors, where industry structure is quite different (i.e., not freelance). This would also help to develop virtual infrastructure and linkages in the ecosystem.

The Organization for Small and Medium Enterprises Sector Development[9]

This organization is a public, non-commercial, non-profit institution created by Government Decision no. 538 of 17 May 2007. It operates in coordination with the MoE and other central and local authorities, business associations, business support providers and SMEs. ODIMM both delivers services itself and manages the Network of Business Incubators (RIAM). Its role as an important part of the country's innovation infrastructure is widely recognized and, as noted in Chapter 4, can be viewed as a "pocket of excellence" in its own right.

Network of Business Incubators (RIAM)

The network of business incubators under ODIMM's auspices operates throughout Moldova offering training and support for start-ups and growth-oriented SMEs. Between 2011 and 2017, incubators were established in Ştefan Vodă, Leova, Rezina, Sîngerei, Dubăsari (Coşniţa village), Soroca, Ceadîr-Lunga, Nisporeni, Cimişlia, Călăraşi and Cahul[10].

Clusters

According to the UNECE Sub-national Innovation Policy Index: Eastern Europe and the South Caucasus (2020), there are 8 clusters in Moldova, including the recently established Cahul Creative Cluster in the south and SORINTEX, a textile cluster in Soroca, in the north of the country. SORINTEX and the Moldova Automotive Cluster are the only clusters currently included in the European Cluster Collaboration Platform (ECCP). A study by ODIMM and the European Commission's Technical Assistance and Information Exchange (TAIEX) Programme identified approximately 20 potential clusters in the country.

In addition, a 2017 study[11] identified 6 scientific and technological clusters focused on the development of cross-innovation potential that were forming organically in Moldova. Most of these clusters sought to create collaborative R&D and innovation projects in, for example, the fields of nanotechnology and new materials, food processing and applications of renewable energy technology in agriculture. No recent activity has been detected in these scientific and technological clusters this year, which suggests that they have either transformed into new models of operation or proved to be financially unsustainable.

Scientific-technological parks and innovation incubators

Under the Law on Science and Technology Parks and Innovation Incubators No. 138-XVI of 21 June 2007, fiscal incentives were offered to the residents of science and technology parks and innovation incubators. Additionally, residents at such locations also benefited from reduced rent for their production facilities and offices as well as a provision whereby 95 per cent of their patent costs were covered by the State Agency on Intellectual Property (AGEPI).

A number of STPs and innovation incubators were created after the adoption of the respective law in 2007 (see Annex 1), however, with the introduction of the revised Law in 2018 the fiscal incentives were lost and, as with the above-mentioned organically forming scientific and technological clusters, no recent activity has been published by any of the parks or innovation incubators. Several of them report that they now exist only 'on paper' and the minimum demand they need to function does not exist. This suggests that the loss of the original fiscal incentives for residents may mean that they are no longer able to compete with other forms of infrastructure e.g. the industrial parks and business incubators. This situation also suggests that co-location or access to knowledge base partners and services is not a sufficiently compensatory incentive for private-sector or start-up engagement, reinforcing the points made in Chapter 4 on private sector demand for innovation in Moldova.

Multi-functional industrial platforms

The current distribution of industrial platforms in Moldova is not uniform, meaning that in many districts there are no specialized locations to attract investment and to ensure sustainable, regional development and the efficient use of human resources. To address this issue, on 13 October 2020, the Government approved the Pilot Programme for the creation of 18 multi-functional industrial platforms (MIPs) in the Republic of Moldova. The main objective of the programme is to increase competitiveness, productivity and employment in the industrial sector in each region of the country.

According to the State Budget Law for 2020, 50 million lei have been provided to fund MIP infrastructure under the direction of ODIMM[12]. MIPs are planned for Cabtemir, Leova, Ialoveni, Anenii Noi, Criuleni, Telnesesti, Singeri, Soldanesti, Glodeni, Riscani, Donduseni and Bricenci as centres of excellence for industrial development.

What is not clear at this time is the degree to which these centres will be regionally specialized, that is, how customized will their operations be to support the specific innovation needs and emerging priority sectors in each region. As the regional aspects of

innovation are seen to be critical for modern economic competitiveness, this issue may be worth revisiting by policymakers to optimally align MIP investments with the Smart Specialization efforts of the Government.

Innovation and technology transfer centres (ITTC)

Moldova plans to create 3 ITTCs, one each in northern, central and southern Moldova. These centres will focus on the development, capitalization and promotion of both research and innovation and TT infrastructure.

Each ITTC will be created and developed through the joint efforts of central state authorities (ministries), local authorities (town halls), regional development agencies, universities, business associations, business support organizations, international donors and so forth. Progress is already being made in this area as the establishment of one of the centres, the Centre for Innovation and Technology Transfer in the Northern Development Region (Balti), started in 2020.

The overall design of the ITTCs is likely to contribute positively to innovation and knowledge transfers/exchanges. They may also provide significant opportunities for increased technology transfer using more advanced and relevant research and their proximity to technology adopters. Nevertheless, a specific strategy may be needed for how to best utilize the capacities of each ITTC, particularly in connection with the commercialization of new research results.

Start-up City Cahul

Start-up City Cahul is located in the southern city of Cahul and is considered to be the first such regional project in the country[13] (see Chapter 3 for more information). It supports efforts in science, technology, engineering and math (STEM) education in close cooperation with other existing initiatives. These cooperative efforts aim to develop and roll out modern, accredited education and training programmes for digital skills that meet the needs of the private sector. Early success in Cahul has led to plans for a similar initiative in Comrat.

Prototype development

There are at least 5 FabLabs in Moldova, including facilities in Orhei, Ungheni, Drochia, Cahul and Soroca. However, it is not currently clear how operational they are. FabLab Chisinau[14] housed in Tekwill Chisinau occupies 700 sqm and presents an important potential to drive experimentation through the small-scale prototyping and production workshops.

Startup Support

Moldova has a growing number of start-up support organizations, such as Start-up Academy Chisinau[15], Generator Hub Chisinau[16], iHub Chisinau[17], Ziphouse Fashion Hub Chisinau[18], Digital Park Chisinau[19], Dreamups Innovation Campus Chisinau - Virtual[20] and ArtCor[21] . As is apparent from their names, the majority of these are located in the capital and focus on IT, with the exception of Ziphouse Fashion Hub, leaving a substantial gap in start-up support at the sub-national level. This situation is unlikely to be organically redressed and will require policy attention.

Government grants for R&D&I

Grant funding for innovation activities comes from both the ODIMM (grants for innovative start-ups) and NARD (see Chapter 3). The latter administers a TT grant scheme with a budget of 8 million lei annually. Before NARD's establishment in 2013, the maximum budget for such projects stood at 400,000 lei which was divided among some 20 projects annually. Starting in 2013, NARD focused on TT projects with the involvement of the private sector on a matching basis with the maximum fund allocation of about 800 million MDL[22]. These changes have contributed to a decrease in the number of TT projects supported annually and a smaller number of projects being awarded to PROs. This change has negatively impacted staff retention at PROs and is best addressed by gradually increasing the budget for TT grants awarded to such organizations (see Chapter 4 for more details).

Venture funding

As noted in Chapter 3, there is no legislation in place in Moldova to regulate venture funding and work on such laws is still at a very early developmental stage. Such lack of equity funding legislation is a serious omission in Moldova's overall innovation support infrastructure and should be quickly addressed (see Chapter 3 for recommendations). While there is a network for business angels (https://www.businessangels.md/) and some evidence of international investors independently reviewing opportunities within the country (Startup Grind Chisinau: SmartGateVC 2019), there appears to be no established domestic mechanism to promote post-seed venture fund opportunities and no evidence of investor interest in the creation of a domestic fund. Several regional private equity funds operate in the country (e.g. NCH Capital, Horizon Capital, Fribourg Capital, 4i Capital Partners), however, none of them deal with SMEs directly as their high minimum investment amount excludes SMEs from the list of clients. Instead, these equity funds invest in financial institutions that serve the needs of SMEs. For example, Horizon Capital purchased a 24.62 per cent stake in FinComBank while NCH Capital purchased Prime Capital and Express Leasing outright[23].

Technology transfer infrastructure

Infrastructure to support TTs from the academic to commercial sector typically comprises support for the commercialization of research through licensing of rights to existing companies or via a 'spinoff/start-up' company. This is normally delivered by a TTO or TT centre (CTT) that identifies and attempts to transfer useful technology while working in partnership with an internal IP unit whose role is to secure IP rights – typically a patent that can be sold or licensed. Generally, universities with a strong focus on working in collaboration with industry and enterprises to innovate may have an industrial liaison office or KT office whose primary role is to stimulate and manage collaborations between a company and academic research teams. Such entrepreneurially focused universities normally offer incubation and acceleration programmes to encourage spinoffs and start-ups from their academic and student bodies. Development in Moldova along these lines would require enhancements to the quality and diversification of research-based and vocation-education based universities (see Chapter 4).

Technology transfer is often done through a dedicated TT office within a university or R&D organization working with the IP unit to explore the opportunities for commercialization of research through licensing of rights.

In Moldova, TT infrastructure remains very under-developed, both in terms of its regulation and the support it receives from both the public and private sectors. Public sector entities that are responsible for protecting and transferring IP are not sufficiently active and Moldova's internal regulations to facilitate traditional technology transfers (e.g. IP policy, spinout regulations) are all but non-existent. Moldova State University is the only university in the country which has an IP policy published on their own website and that of the World Intellectual Property Organization (WIPO). Other TEMPUS partners (The Technical University of Moldova (TUM), The State Agrarian University of Moldova (SAUM) and Alecu Russo State University of Balti (USARB)) do not seem to have taken steps to regulate or promote action on this issue. This lack of regulation has an inhibiting effect on TT and knowledge exchange activities with existing enterprises as well as hampering the creation of new 'start-up/ spinoff' companies.

Entities tasked with promoting IP and IPR are not sufficiently active and the few TT offices for research commercialization lack skilled personnel.

When it comes to TTOs in Moldova, units specifically designed to support the commercialization of research, one exists at the State University of Moldova while the three that were initiated under the TEMPUS funded project "Technological Transfer Network – TecTNet[24]" do not seem to be active. The Alecu Russo State University of Balti is a stakeholder in the planned northern Centre for Innovation and Technology Transfer[25].

Given the Government's current focus on knowledge exchange (rather than traditional means of TT through research commercialization), the absence of a strong body of actors to commercialize research is neither surprising nor particularly significant at this time. However, access to qualified personnel who can support research commercialization when this is needed is a missing element that should be addressed.

Despite a relatively diverse array of innovation infrastructure, TT infrastructure is under-developed and lacks both efficient linkages and adequately skilled personnel

Moldova established its first physical innovation infrastructure for enterprise-led innovation in the 1990s. Platforms (FEZs and Industrial parks) where advantageous tax regimes apply have been quite successful and provided a solid foundation for expansion into new initiatives such as the Moldova IT Park and the Tekwill model. These multi-functional industrial platforms are a natural development to address a need for more infrastructure across the country and to ensure that innovative activity is not dominated by the IT sector to the detriment of other large and more traditional sectors, such as agriculture and textiles. The platforms also help to avoid a capital-centred model of innovation as they strive to close infrastructure gaps throughout the country. Provision of such shared and specialized infrastructure, particularly for R&D&I, can significantly help to accelerate innovation and, if well implemented, would be a significantly positive development.

There are no venture accelerators in Moldova, even though they are crucial to develop and scale-up innovative businesses.

Despite Moldova's diverse innovation infrastructure, including industrial parks, FEZs, business incubators, FabLabs and multi-functional industrial platforms, there is a notable absence of venture accelerators. Venture accelerators are organizations that support start-ups by accelerating business growth and development by providing funding, including seed capital and later-stage funding, in return for a small amount of equity in the start-up.

Infrastructure to support research commercialization, such as TTOs and industrial liaison offices, is underdeveloped in Moldova and creates multiple issues, including in the areas

of IP protection, the provision of services to access the market and gathering information on competitors. Researchers lack incentives, such as an institutional reward scheme embedded in an IP Policy, to engage in regulated TT activity and, even more critically, there is little evidence of a cadre of personnel with the skills, know-how and experience to negotiate classical TTs through the sale or licensing of IPR. Without these individuals, some researchers will continue to operate independently of the institutional framework while those that remain within the framework are unlikely to see their innovations secure a national or international licensing agreement as expecting progress beyond a domestic patent is unrealistic.

Researchers lack incentives to engage in classical TT regulated activity and TTO personnel often lacks skills and know-how to negotiate the sale and licensing of IPR.

While public funding for applied academic research remains low (see Chapter 4), the lack of infrastructure for classical TT at individual PROs is not the primary concern because there is little applied research with innovation potential being conducted in PROs that could be transferred to business. However, as the 2020-2023 National Programme for Research and Innovation points out, there is a clear intention to shift from the goal of facilitating technology transfers to the goal of facilitating KTs. This means that the lack of adequately skilled personnel to perform knowledge-transfer tasks, a key component of the virtual infrastructure needed to initiate and manage long-term relationships between researchers and enterprises, is a serious shortcoming. This may be partially addressed through projects like Tekwill and the planned ITTCs, however, it will require a strong focus on skills development if the reported gap between the private and public sectors is to be bridged (see below).

The use of the infrastructure is quite low with some types, particularly STPs and innovation incubators, reporting low demand for their services. In addition, linkages between infrastructure components appear very weak with both private and public sector actors reporting the existence of a detrimental gap that is not addressed by conventional means, such as by the actions of TTO staff.

The use of existing infrastructure is often suboptimal with STPs and innovation incubators seeing little demand for services.

A more detailed gap analysis of the relevant physical infrastructure, supported by a focus group to examine the functionality of the relevant virtual infrastructure, has identified a number of barriers for development and key areas that could be targeted for further development. The details of this gap analysis are briefly outlined below.

Enhanced linkages within TT infrastructure would require addressing bottlenecks in TT legislation, the creation of robust innovation hubs at the sub-national level and improving TT capacity

As outlined in earlier sections, TT infrastructure in Moldova has only recently come into being and holds significant potential for the country`s innovative development. To tap into this potential, the Government would ideally put in place measures to enhance the TT regulatory environment to facilitate the introduction of new products, services and processes into the market. Furthermore, the regulatory environment should serve to develop links between the TT infrastructure and support sub-national governments efforts on smart specialization while also assisting the commercialization of technology through a dedicated national-level TTO (similar to that operating in Georgia). Finally, the Government should enable sub-national governments to design their own support programmes to provide more virtual innovation infrastructure to close the rural-urban divide in innovative development.

Improving the regulatory environment for TT to provide for the right incentives and enabling mechanisms

Legislation on innovation and TT infrastructure continues to be criticized by a range of national stakeholders as not effectively serving the purpose it is intended for – providing the right incentives for the uptake of innovative entrepreneurship.

Review the current law on scientific and technological parks and innovation incubators to assess and improve the catalytic effect of various incentives and support mechanisms to stimulate demand and boost the project pipeline.

During the fact-finding mission conducted for this review, it was suggested at the dedicated focus group that the current law on STPs and innovation incubators could be improved by including financial incentives, similar to those offered in its 2007 version. This is seen as potentially beneficial as it would encourage more use of STPs and innovation incubators located within universities. This would also be an important step towards creating a 'level playing field' with the various industrial parks and business incubators who enjoy tax incentives. There is a high degree of confidence that amending the law in this manner will produce benefits based on the experience derived from the law on IT parks. However, it is strongly suggested that other incentives are offered and that run in parallel to the financial ones. Enterprises and start-ups should take a decision to (re)locate to such infrastructure based on the knowledge services of its host, proximity to a knowledge provider and the benefits to be gained from proximity to other similar companies *(Recommendation 5.1.1)*. Offering solely financial benefits will not necessarily attract the type of enterprises that are best suited to benefit from the environment and forge long term relationships with the associated university. Indeed, by only offering financial incentives there is a danger that innovation incubators will start competing with business incubators while STPs compete with industrial parks for residents. Addressing the specific science and innovation requirements needs to be the main incentive to engage the private sector. Typically, this involves gaining access to an R&D partner that can provide high-level services, modern facilities and qualified personnel, including options for long-term R&D collaborations and short-term student placements. Internal TT and IP-related regulations enabling these services and a framework for meaningful engagement to be offered are a pre-requisite for sustained improvement in these areas.

Government action is needed to facilitate procurement and import practices of specialized equipment for testing and development of researched technologies.

Legislative, bureaucratic and financial barriers to procuring the necessary starting materials and equipment for both new product development and placing the product on the domestic and international markets were reported as having negative impacts on the commercialization of technology and innovation. These issues should and can only be addressed by the Government *(Recommendation 5.1.2)*. Some of the challenges here, particularly those confronting public sector institutions, could be resolved through the introduction of specific measures to facilitate the procurement and import of specialized equipment to test and further develop technologies that are being researched *(Recommendation 5.1.3)*.

The agricultural sector, which is seeking to innovate using new imported seeds and exported plants, reports significant delays in certification processes with the duplication of tasks and paperwork also adding to costs *(Recommendation 5.1.2)*. Overall, the provision of TT and innovation infrastructure for traditional sectors with innovation potential needs to be accompanied by a corresponding optimization of sector-specific legislation and regulation.

Sector-specific TT and innovation support mechanisms should be put in place that go beyond the IT sector and are in line with Smart Specialization policy efforts

As previously noted, there are encouraging signs that Moldova is continuing to diversify and embrace new approaches to TT and innovation infrastructure and to include emerging priority sectors, such as IT, in these efforts. However, this sector-specific refinement approach seems to currently be overly focused on the IT sector with the Tekwill initiative and the independent start-up and acceleration support offered at the many hubs in Chisinau being very IT-centred This has left several other sectors with important innovation potential languishing without proper attention (see Chapter 2).

Priority sectors, such as health and agriculture, have been identified as such under a Smart Specialization effort in Moldova. The approach based on the sector-specific infrastructure can be instrumental in encouraging innovation in various sectors with positive spill-over effects at the sub-national and national levels. This approach has become increasingly commonplace in the EU where incubators, accelerators, STPs are tailored to each sector's needs while more general support is provided under the mandate of SME agencies and traditional business incubators. Some established entities that serve as good examples in this regard include the CleanTech Incubator (EU)[26], the Green Incubator (Ukraine)[27], the Bucharest Carbon Incubator/ Accelerator (Romania)[28], the Prague AI Startup Incubator/ Accelerator (The Czech Republic)[29], EBRD Ukraine Climate Innovation Voucher[30], to name but a few.

Sector-specific TT and innovation support mechanisms can be instrumental in encouraging innovation in the various sectors identified under the S3 efforts as having substantial potential for spill-overs at the sub-national and national levels.

In the Moldovan context, the first step may be linking innovation and TT infrastructure more closely to the priority sectors identified by the Smart Specialization efforts while encouraging the sector specialization of physical and virtual infrastructure (e.g. prototyping, incubation, acceleration and R&D Services) *(Recommendation 5.2.1)*. These steps could be followed by measures to encourage international linkages to similar activities abroad (mentoring and twinning), including with the EU *(Recommendation 5.2.2)*. This could then be subsequently followed by the development of sector-specific advisory services to encourage innovation in these priority sectors by building capacity with regard to specialized knowledge of prototyping, streamlining the accreditation process and so forth *(Recommendation 5.2.3)*.

A national TTO, as well as TT contacts within PROs with the right academic and commercial skills, would significantly enhance Moldova's TT infrastructure

The least developed type of innovation infrastructure in Moldova is that which supports TTs from the public to the private sector and facilitates research commercialization, including through collaborative efforts such as 'knowledge transfer/exchange' mechanisms. While funding is present for TT activity from NARD in the form of TT grants, there is very little institutional support to validate research results and transfer them to the market. Such validation and transfer processes require specialized skills to assess the market for a concrete product and help the research team to refine it to meet market needs. Furthermore, funding is required for intellectual property actions, technology adopter identification and the negotiation of transfers. These are typical activities for a TTO and the quality of the skills and experience of its personnel is critical for the success of such activities.

Dedicated support mechanisms to manage collaborations between PROs and the private sector are missing while gaps in the internal frameworks of PROs limit effective technology transfers.

Another important element with regards to the TT infrastructure in Moldova is the absence of dedicated support to initiate and manage collaborations between PROs and the private sector. These gaps, for example, make it difficult to search for short-term and long-term strategic partners, make contact with these partners and then manage both the working relationships and project to optimize outcomes. These are typical activities for a knowledge exchange or KT office. Finally, there is an absence of internal regulations that supply the necessary framework to enable TT to take place, such as a streamlined IP policy and revenue sharing schemes at PROs.

As indicated in Chapter 4, Moldova is not currently investing heavily in public research. However, as has been previously emphasized, there are 'pockets of excellence' within the economy, although these are scattered across different sectors and institutions. Individually, these are unlikely to provide a sufficiently strong innovation pipeline to allow any single organization to employ a team with the diverse skills needed to successfully develop and/or commercialize innovative technology. Establishing a TTO with one or two generalists who can manage a small number of mildly innovative projects will not lead to the office eventually having the skills needed to realize the full potential of any significant R&D projects that arise in the future. In this situation, there is often a focus for TTO staff on awareness-raising and educational activities for researchers to initiate the change of culture. While these are important activities to stimulate TT, they require very different skills than those needed to sell technology to the business sector.

Establishing a national TTO can help pool skilled staff and ensure the creation of a solid pipeline of TT projects based on successful examples seen abroad.

Against this background, there is merit in pooling the various PROs' technology pipelines to attain the critical mass of research outputs necessary to sustain a national TTO *(Recommendation 5.3.1)*. This 'hub and spoke' model can make it economically viable to recruit the highly specialized individuals needed to formulate and implement a strong IP strategy, undertake market research as well as negotiate and execute licensing deals. This centralization of PROs means that they could also individually benefit from a single dedicated patenting fund, although this should be strongly linked to the availability of skills to transform a patent into a patent licence or achieve the full sale of rights.

It is also necessary to ensure very strong and active linkages between the central "hub" TTO and the PROs, which are the "spokes" that collectively form the pipeline. These linkages can be initiated through an MoU. However, developing and maintaining active linkages that yield technologies that can be transferred requires ongoing efforts from individuals in both the TTO and the PROs *(Recommendation 5.3.2)*. Without ongoing dialogue and interaction, the "hub" can rapidly become isolated and left without a strong pipeline of projects. In this regard, one option to assist PROs to maintain communications with and support the TTO would be for each such organization and institute to establish a KT office (see below).

Examples of TTOs that serve a pool of PROs include the Podkarpackie Centre for Innovation (PCI)[31] in Rzeszów, eastern Poland, and PROvendis[32] and Ascension[33] in Germany. Georgia is also moving towards adopting this type of 'hub and spoke' model[34]. Another example, this time of a funding scheme that helps to create a technology pipeline from PROs, is the Polish Inkubator Innowacyjności[35], whose operations and procedures could serve as an inspiration for a Moldovan version.

The espoused move from a linear model of technology commercialization towards more KT mechanisms is a positive. This is because KT involves a partner who already understands

market needs and provides a direct window into the market. The chances of success are therefore often much higher in KT collaborations than they are using traditional research commercialization methods.

A knowledge transfer approach to technology commercialization increases the chances for success and requires establishment of a designated KT contact point in each PRO.

However, successfully establishing a KT office also requires investment in people with specialized skills that allow them to do more than engage in education, awareness raising and culture change. Such people typically 'sell' short- and long-term R&D expertise and need to be able to work well with and command the respect of their partners in both academia and the business sector. Designating such a person as the contact point for KTs and TTs in each PRO could be extremely beneficial *(Recommendation 5.3.3)*. These individuals are natural liaison points for a national TTO and provide the constant active link that is required between research teams and commercialization experts for a 'hub and spoke' model to work. Acting on this recommendation can result in long term strategic partnerships where businesses will come to regard particular university research teams as a key R&D resource for the company.

Bringing research to the market will require active stakeholders at each PRO and agreed KPIs with the national TTO.

Such a development would contribute to the implementation of the ITTCs planned by the Government of Moldova. However, a clear focus needs to remain on the ultimate goal of bringing research results from PROs, financed by TT grants or from public funding, to the market. Any national "hub" will require an active counterpart at each PRO to identify opportunities and help manage the dialogue with the research teams. It would also need to set clear joint KPIs for both the TTO and each of the PROs (e.g. to focus on the TT and not just the conversion of a patent into a licence) to drive the disclosure process and the establishment of an acceptable reward scheme to stimulate disclosures *(Recommendation 5.3.4)*.

A clear focus on sub-national and local level innovation and TT infrastructure is needed to overcome the rural-urban gap and foster innovative development throughout Moldova

There is a strong government focus on providing virtual innovation infrastructure to organizations in the capital, particularly incubation and acceleration services for the IT sector and, in line with this, physical infrastructure has tended to be concentrated in a small number of locations. A promising development here is that the need for more geographically spread physical infrastructure is being partially addressed through the 12 planned multi-functional platforms and the 3 planned ITTCs. It is also encouraging to see Tekwill's success in scaling-up at the sub-national level and that Start-up city Cahul, which is clearly regional in nature, has plans to expand into other regions (e.g. Comrat).

Tailoring innovation and TT infrastructure to a region is among key factors for its competitiveness and innovative development, both in terms of skills and investments retention and attraction.

Similar to the benefits that flow from providing sector-specific infrastructure, there are benefits in developing infrastructure that is tailored to a particular region. Regions often have a clear natural focus for their innovation activities, e.g. food and agriculture or textiles, as well as their own HEI strengths and business needs. If regional strengths and needs are not sufficiently met by suitable infrastructure, the regions will become increasingly less competitive and skills progressively lost. Skilled workers migrate to better-supported sectors or new locations in Moldova and abroad in the context of poorly developed regional innovation support ecosystems (see Chapter 6).

Complementing the suggestions provided in Chapter 3 on the promotion of innovation at the sub-national level, this chapter has focused on the customization of the instruments that support national development strategies as a useful way to encourage a bottom-up

approach to local innovation and TT. This customization process can include enabling regions to design schemes for virtual infrastructure that cater to their local needs and strengths while still aligning with the goals of the national innovation strategy. Poland serves as a good example in this regard, where regional development agencies (Marshal Offices) have been designing their own pilot schemes to help TTs and KTs from PROs to private enterprises. This approach was adopted to increase the competitiveness of each region based on the strengths of local high schools and universities while meeting the specific needs of local companies[36].

Having a regional focus when developing adequate and locally relevant infrastructure is the optimal path to closing the rural-urban gap in innovation while addressing local socio-economic challenges throughout the country.

It is recommended that the Government examines mechanisms to enable its regions to design their own support programmes to provide more virtual innovation infrastructure and to support local innovation capacities *(Recommendation 5.4.1)*. These should complement local strengths and address local needs *(Recommendation 5.4.2)*, align with the national strategy for innovation and leverage the opportunities offered through physical infrastructure such as the various multi-functional platforms and planned ITTCs. Establishing stakeholder groups willing to implement action at the regional level (e.g. through co-funding for physical infrastructure) *(Recommendation 5.4.3)* and exploring options through pilot schemes *(Recommendation 5.4.4)* have proven elsewhere to be steps that have led to positive outcomes.

Policy recommendations

Moldova has made good progress in developing some physical infrastructure to support innovation in a number of sectors. This progress continues with new physical and virtual infrastructure being introduced in more locations to meet the needs of a wider array of sectors. However, areas of concern remain, particularly the lack of infrastructure to support TTs, which are crucial for the commercialization of research results.

There are viable options to further improve the legislative and regulatory environment, develop sector-and region-specific infrastructure, create a critical mass of coordinated research institutes to form a functional TT pipeline and link emerging KTs to stronger TTs. The outcome from all of the foregoing is four main policy recommendations, which are summarized below, to develop innovation and technology transfer infrastructure in Moldova (Table 5.1).

Table 5.1 Summary of policy recommendations to develop innovation and TT infrastructure

Recommendation 5.1: Optimize the **regulatory environment** to address current shortcomings and barriers to developing innovation infrastructure and the introducing new products, services and processes to the market.

The current legislation does not sufficiently enable and incentivize efficient innovation and TT infrastructure, with the need to address bottlenecks in accessing innovation support, the adoption of new technology and certification requirements.

Actions	Priority	Time-frame	Roles
5.1.1. **Review the current law on scientific and technological parks and innovation incubators** to assess and improve the catalytic effects of various incentives and support mechanisms to better stimulate demand and boost the project pipeline.	①	Short-term	The Government (initiated by the MER)
5.1.2. **Remove product-certification barriers** to eliminate excessive costs associated with double certification requirements to enter national and international markets (both imports and exports) with a particular focus on agricultural-sector products.	②	Short-term	Relevant agency, initiative by the MER and MAFI
5.1.3. **Improve the procurement and import practices of specialized equipment** for testing and further developing technologies, particularly for public sector institutions.	③	Short-term	The MER, MAFI, MoE

Recommendation 5.2: Develop **sector-specific TT and innovation infrastructure**, linking it to national development priorities and Smart Specialization efforts.

Against the background of the government's extensive focus on the IT sector which has been a success, it is also important to put in place sector-specific TT and innovation support mechanisms to promote innovation in other sectors. While regional innovation governance is currently quite weak, having a sector-specific focus at the regional level, that is in line with Smart Specialization principles, would help drive innovation throughout the entire country.

Actions	Priority	Time-frame	Roles
5.2.1. **Link innovation and TT infrastructure more closely to the priority sectors** identified under Smart Specialization efforts, encouraging the development of sector-specific physical and virtual infrastructure (e.g. for prototyping, incubation and acceleration activities as well as providing R&D services).	①	Long-term	The MER, NARD, MoE and ODIMM
5.2.2. **Encourage international linkages** with international actors engaged in similar TT activities and using similar innovation infrastructure abroad (mentoring and twinning) to accelerate development processes, including through the use of EU funds.	③	Medium-term	The MER, NARD and MoE
5.2.3. **Develop sector-specific advisory services** to encourage innovation in priority fields, e.g. through specialized knowledge of prototyping and accreditation processes.	②	Medium-term	The MER, NARD

Recommendation 5.3: Support research commercialization through a **national TTO** and **KT skills** at each PRO.

TT infrastructure is the least developed type of innovation infrastructure in Moldova, with few active TTOs and TT efforts dispersed among multiple institutions, requiring a robust pipeline of TT projects as well as skilled and well-trained staff to effectively perform TT tasks.

Actions	Priority	Time-frame	Roles
5.3.1. **Establish a national TTO** to pool skilled staff and ensure a solid pipeline of TT projects based on successful models employed abroad.	①	Short-term	The MER, NARD, PROs and HEIs
5.3.2. **Require PROs** to **establish a clear IP policy,** including a revenue-sharing scheme for other research partners and an MoU or similar with the national TTO.	①	Short-term	The MER, NARD, PROs and HEIs
5.3.3. **Require each PRO to designate an internal partner** to ensure effective communication and TT (e.g. a KT or TT Office).	②	Short-term	The MER, NARD, PROs and HEIs
5.3.4. **Set clear joint KPIs for both the TTO and the PROs** to drive the disclosure process and establish an acceptable reward scheme to stimulate disclosures.	①	Medium-term	The MER, NARD, PROs and HEIs

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Table 5.1 Summary of policy recommendations to develop innovation and TT infrastructure (Concluded)

Recommendation 5.4: Adopt a **clear regional focus** for innovation and TT infrastructure.

With most innovation happening in the capital using the relatively strong innovation support infrastructure located there, there is a need to facilitate the development of adequate and locally relevant infrastructure in the regions to close the rural-urban gap in innovation and effectively address local socio-economic challenges.

Actions	Priority	Time-frame	Roles
5.4.1. **Establish a mechanism to enable funding** for local physical and virtual innovation infrastructure (grants and support services) to be designed and administered at the sub-national level.	②	Medium-term	The MER, NARD and MIRD
5.4.2. **Undertake regional SWOTs** and needs analyses to design customized local support.	①	Short-term	The MER, NARD and MIRD
5.4.3. **Establish stakeholder groups** willing to implement actions, including via co-funding for physical infrastructure.	③	Medium-term	The MER, NARD and MIRD
5.4.4. **Pilot actions and refine programmes on TT** to ensure they meet existing needs and yield the intended results.	①	Medium-term	The MER, NARD and MIRD

Source: The UNECE.

Annex 1: Innovation and TT infrastructure questionnaire and SWOT

Part 1: For universities and research institutions (PROs)

Below are a number of questions related to the innovation ecosystem in Moldova and how well it functions to support TT and innovation. The questionnaire is designed to help the UNECE team to identify possible barriers and gaps that hold the country back from efficiently and effectively engaging in TTs and innovation. Please try to answer the questions fully and add short explanations to your answers if possible.

Name of your university/ research institute	
Your name	
Your position	

Policy, Legislation and Regulation

1. Do you see any significant barriers to engaging in technology transfers that are caused by current policy regulating science and innovation? If so, what is the main issues and how could this be addressed?

Yes/ No

Comment:

2. Do you see any significant **legislative** issues that affect technology transfer and research commercialization, e.g. ownership of research results obtained using public funds? Or the current law on science and technology parks and innovation incubators? If so, what are they and how could they be addressed?

Yes/ No

Comment:

3. Does your institution have an '**IP policy**' that regulates the ownership of research results with innovation potential?

Yes/ No

Comment:

4. Does this policy also regulate profit sharing from successful research commercialization efforts?

Yes/No

Comment:

Resources and Skills

1. Does your PRO have a person or group who support IP protection for research results? If yes, what are their main responsibilities?

Yes/No

Comment:

2. Does your PRO have a technology transfer office or similar business unit that is responsible for helping the commercialization of research results? If yes, how many people are employed full- or part-time in the unit?

Yes/No

Comment:

Main challenges to research commercialization at your institution

1. Please rank the challenges to research commercialization listed below from 1 (most challenging) to 10 (least challenging).

	Rank
Strength of present research outputs	
Interest of researchers in commercializing their research	
Strength of the skills needed to bring results to the market, e.g. licensing negotiation skills	
Interest from business in working with academic researchers	
Availability of funding for R&D&I, e.g. to fund applied R&D and prototyping	
Availability of funding to support technology transfer activities, e.g. to fund a technology transfer office	
Availability of 'follow-on funding' from venture funds (non-grant and bank sources)	
Availability of physical infrastructure, e.g. incubators	
Availability of virtual infrastructure, e.g. personal contacts, networks and knowledge intermediaries as well as brokers	
Other (please outline below in the space for comments)	

Comment:

SWOT

Using the template below, please try to identify the strengths, weaknesses, opportunities and threats to the technology transfer and innovation infrastructure in Moldova. Rank your responses as high, medium or low.

Aspects you may wish to consider could include:

- legislation and regulation related to intellectual property rights, infrastructure and incentives to innovate;
- funding and access to finance;
- physical infrastructure (technology transfer offices, incubators and tech parks);
- virtual infrastructure (personal contacts, networks, and knowledge intermediaries and brokers);
- human and financial resources devoted to R&D;
- skills and competencies necessary for research commercialization and business innovation.

Strengths	Weaknesses	Priority
		High
		Medium
		Low

Opportunities	Threats	Priority
		High
		Medium
		Low

Notes

1 http://www.innovationpolicyplatform.org/

2 I.e. research commercialization

3 See THE INNOVATION ECOSYSTEM OF MOLDOVA Report prepared under UNIDO Country Programme for Moldova 2019-2023 October 2020.

4 World Bank http://documents1.worldbank.org/curated/en/697401467999092957/pdf/103998-REPF-Moldova-Trade-Study-Note-4-Performance-of-Free-Economic-Zones-in-Moldova.pdf

5 The relevant law states that these parks occupy a specifically delimited territory with technical and production infrastructure and where economic activities are conducted. These activities are mainly industrial production, service delivery, the capitalization of scientific research and/or technologic development in a regime of specific facilities, including a beneficial tax regime, with the intention to capitalize on the human and material potential of a region.

6 For more information see: https://MoE.gov.md/en/content/industrial-parks

7 For more information see: https://www.tekwill.md/

8 https://moldovaitpark.md/wp-content/uploads/2020/02/Raport-Anual-2019_eng-1.pdf

9 See https://odimm.md/en/

10 For more information see https://increast.eu/en/172.php

11 Review of the state of development of clusters in the EU's Eastern Partnership countries available at https://s3platform.jrc.ec.europa.eu/en-US/w/review-of-the-state-of-development-of-clusters-in-eap-countries

12 More information can be found at https://mec.gov.md/sites/default/files/platforme_industriale_multifunctionale.pdf

13 For more information see: http://startupcitycahul.md/en/

14 For more information see https://utm.md/blog/2018/05/05/ start-fablab-chisinau/

15 https://www.startupacademy.md/

16 See: https://hub.md/en

17 See https://www.ihub.md/

18 See https://www.ziphouse.md/

19 See https://digitalpark.md/en/

20 See https://dreamups.com/

21 See https://artcor.md/ro

22 For example, in 2017, a project of around 1 million MDL was awarded to the residents of the industrial parks.

23 See https://www.popa.md/wp-content/uploads/2018/04/Ventrure-capital-final2-1.pdf

24 See http://www.agepi.md/en/news/tempus-project-%E2%80%9Ctechnological-transfer-network-%E2%80%93-tectnet%E2%80%9D-%E2%80%93-first-year-review

25 See https://stroyka.md/en/news/tsentr-innovatsij-i-transfera-tekhnologij-budet-sozdan-na-severe-strany

26 See The Cleantech Incubation Policy and Practice handbook http://cleantechincubation.eu/good-practices

27 See https://greencubator.info/?lang=en

28 See https://carbon-incubator.com/

29 See https://www.suincubator.ai/

30 See https://www.ebrd.com/news/2017/ukrainian-companies-benefit-from-new-funding-for-climate-technology-innovation-.html

31 See https://ec.europa.eu/regional_policy/en/projects/Poland/podkarpackie-centre-for-innovation-in-poland-brings-science-business-together

32 See https://provendis.info/en/

33 See https://www.ascenion.de/en/

34 See https://gita.gov.ge/eng/static/155/ttpp

35 See http://www.bip.nauka.gov.pl/inne/komunikat-ministra-nauki-i-szkolnictwa-wyzszego-z-dnia-19-sierpnia-2016-r-o-ustanowieniu-programu-pod-nazwa-inkubator-innowacyjnosci.html

36 Regional pilot schemes in Poland include Business-Led Challenges (Dolnoslaskie region); Partnership for University-Industry Cooperation and Proof-of-Concept (PoC) Support Programme (Podlaskie region); and Lodz Enterprise Innovation Support and Poland I-Corps Programme (Lodz region). See World Bank Report 2019 https://documents.worldbank.org/en/publication/documents-reports/documentdetail/321551561356314044/poland-catching-up-regions-3-overview-report

Chapter 6

LEVERAGING THE DIASPORA FOR INNOVATION-DRIVEN SUSTAINABLE DEVELOPMENT

Main messages

- The Moldovan diaspora is relatively young, with pre- and post-independence migration complemented by more recent migration flows. Generally, Moldovan migrants leave the country for economic reasons, often hold Romanian citizenship and are primarily employed in lower-skilled occupations. Currently, there is a lack of data to build a nuanced understanding, in terms of location, composition and so forth, of the Moldovan diaspora and this hampers efforts to fully leverage it for innovation-driven sustainable development.
- Those residing permanently abroad account for the largest proportion of highly-skilled individuals in science, technology, engineering and mathematics (STEM) as well as medicine and other knowledge-intensive occupations. These individuals are the least likely section of the diaspora to return to Moldova, however, they are often eager to contribute to development in their former homeland. As such, developing and maintaining a flexible mechanism for highly-skilled diaspora engagement could greatly benefit knowledge transfer to Moldova.
- Moldova has implemented a relatively successful and diverse policy approach towards diaspora engagement, with initiatives such as the Program on Attracting Remittances into the Economy (PARE 1+1), the Diaspora Succeeds at Home Programme (DAR 1+3), Diaspora Engagement Hub and Diaspora Excellence Groups. These bodies have enjoyed substantial support from donors and have been successful at engaging the diaspora in local development and strengthening links between diaspora members and their former hometowns.
- Despite this relative success, most diaspora engagement programmes face sustainability issues due to a lack of long-term funding, adequate resources and operational infrastructure, a situation that is compounded by wavering trust in state-led initiatives.
- To turn 'brain drain' to 'brain gain' and attract investment, a clear diaspora policy with concrete support mechanisms should be elaborated. Ideally, such mechanisms would have substantial backing from international donor organizations alongside private sector and diaspora engagement to implement effective and sustainable initiatives.

Recommendations at a glance: Leveraging the diaspora for innovation-driven sustainable development

Recommendation 6.1: Build a nuanced understanding of the composition, location, professions, networks and skills of Moldovans abroad by systematically collecting, updating and analysing statistics and surveys.

Actions	Priority	Time-frame	Roles
6.1.1. Establish a voluntary registry of Moldovans abroad.	②	Short-term	The Diaspora Relations Bureau (DRB)
6.1.2. Identify "hub" institutions to serve as engagement platforms, particularly for the diaspora's science-oriented members.	①	Short-term	The DRB
6.1.3. Conduct regular diaspora census exercises and other surveys.	②	Medium-term	The DRB, with potential support from the United Nations Development Programme (UNDP)

Recommendation 6.2: Consolidate, leverage and scale up existing capacities and mechanisms so they reflect international best practices for diaspora engagement while drawing upon and expanding on Moldova`s current and past experiences.

Actions	Priority	Time-frame	Roles
6.2.1. Integrate diaspora engagement across relevant policy areas through policy documents and programmes (e.g. a national development strategy).	①	Short-term	The Government of Moldova and the DRB
6.2.2. Enlarge the scope for pilot diaspora engagement initiatives among potential sector or regional hubs.	②	Medium-term	The DRB, partner groups and hometown associations (HTAs)
6.2.3. Expand and build momentum around existing formal and informal academic and professional networks.	①	Long-term	The DRB, MER and MoE

Recommendation 6.3: Develop and maintain flexible engagement infrastructure to interact with the diaspora and foster synergies between diaspora development proposals and Moldova's needs.

Actions	Priority	Time-frame	Roles
6.3.1. Establish an online diaspora engagement portal that would offer direct connections and communication channels between the diaspora and Moldova-based participants.	①	Short-term	The DRB, UNDP, HTAs, MoE and tech-groups
6.3.2. Reinforce consular contacts to identify key competencies in the diaspora and establish new connections with counterparts in Moldova.	②	Medium-to-long- term	The DRB and Ministry of Foreign Affairs

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Recommendation 6.4: Develop linkages between academia in Moldova and Moldovan researchers, scientists and affiliated organizations based abroad through the **establishment of a Diaspora Science Group (DSG)**.			
Actions	**Priority**	**Time-frame**	**Roles**
6.4.1. Establish the DSG under the auspices of the DRB.	①	Short-term	The DRB and consulates abroad
6.4.2. Introduce mentorship and fellowship programmes under the guidance of, or run directly by, the DSG.	③	Long-term	The DSG, DRB, HTAs, MER and MoE
6.4.3. Ensure the DSG actively participates in high school, university and vocational education processes in Moldova.	②	Medium-term	The DSG, DRB, MER, UNDP and multilateral donors
Recommendation 6.5: Elaborate policies to maintain contact and enhance trust between the diaspora and Moldova while strategically engaging with Moldovans living abroad to benefit the homeland.			
Actions	**Priority**	**Time-frame**	**Roles**
6.5.1. Facilitate a closer association between the diaspora and Moldovan universities by introducing and maintaining alumni networks.	①	Short-term	The DRB, MER and higher education institutions (HEIs)
6.5.2. Minimize the overall administrative and financial burden for the diaspora engaged in development initiatives in Moldova, especially for active professionals and scientists, to encourage greater cooperation.	①	Short-term	The DRB, DSG, HTAs and Government of Moldova
6.5.3. Sustain a meaningful cultural connection with the diaspora through dedicated events and initiatives.	②	Medium-term	The DRB and HTAs
6.5.4. Enhance and maintain trust in diaspora policy development through systematic engagement with diaspora members.	③	Long-term	The Government of Moldova and DRB in partnership with HTAs and the DSG
6.5.5. Develop a transparent system of public recognition of achievements and contributions of individual diaspora members.	③	Long-term	The DRB and Government of Moldova

Source: The UNECE.

Providing sustainable strategic mechanisms to support diaspora-focused policy building on the past and current policy initiatives

Similar to some other transition economies in the region, Moldova has high outward migration, a trend that creates both challenges and opportunities for the country. Leveraging this expatriate human capital and productively reconnecting it with the national economy has the potential to help internationalize various domestic science and technology sectors and broadly boost local innovative development. The diaspora already appears as a policy agenda item in several strategic documents, such as the National Programme for Research and Innovation 2020-2023, where research collaboration with diaspora-based scientists was cited as a priority objective. In addition, the diaspora was recognized as a key resource for Moldova's development in the "Diaspora-2025" strategy[1], which aims to develop a strategic and operational framework for the diaspora. This framework includes aspects that range from migration and development, building mutual trust, mobilizing, harnessing and recognizing the diaspora's human capital potential as well as engaging the diaspora directly and indirectly in sustainable economic development initiatives.

The diversity of Moldova's operational initiatives and working models to engage with its diaspora are impressive. Initiatives such as PARE 1+1 stimulate local business creation by the diaspora while DAR 1+3 promotes diaspora investment in local development as well

Moldova has shown clear commitment to harnessing the potential of its diaspora for economic development but initiatives lack strategic and sustainable mechanisms to deliver on this commitment.

as projects designed to engage the diaspora in local scientific activities and policymaking. The Diaspora Excellence Group, which runs a programme on temporary return of Moldovan scientists, is a commendable example of a policy initiative aimed at strengthening links with diaspora for innovative development purposes. In addition, a mechanism to coordinate diaspora policy has been put in place with the establishment of an Inter-ministerial Committee on the Diaspora, Migration and Development as well as a framework to monitor and evaluate national policies in the field. However, as this review's analysis showed, the existing mechanisms to engage the diaspora are unsustainable and still fail to systematically exploit the diaspora's capacity to support innovation-led growth and sustainable development in Moldova.

This chapter first reflects on the definition of diasporas in general and what the term entails for Moldova more specifically. This is followed by a review of Moldova's migration profile and operational diaspora engagement projects. The subsequent section addresses the topics of 'brain drain' and 'brain gain' with a discussion of representative cross-country cases that have successfully harnessed their diasporas' potential. The chapter concludes with policy recommendations that may enable the Moldovan diaspora to become a significant contributor to innovation-driven sustainable development in the country.

Defining a diaspora conceptually and in the case of Moldova

The Moldovan diaspora is relatively young, with pre- and post-independence migration

A diaspora is a network of culturally or nationally affiliated individuals with some common background, living outside the borders of their perceived native land.

The literature on economic development and international business still often conceptualize diasporas as well-coordinated examples of social capital, namely, that each is a relatively cohesive cooperative network formed by a given demographic that shares similar values and goals. The modern usage of the term diaspora, referring to overseas communities, expatriates and minorities from a particular country, came into use in the late 1960s[2] and often carries an implied notion of uniformity. However, it is important to highlight the heterogeneous nature of diasporas that are often geographically disperse over time and have their own internal dynamics. These dynamics may be created by factors such as when waves or groups of migrants left their homeland, the reasons why they left, their age, profession, educations and so forth. The International Organization for Migration (IOM) defines a diaspora as "migrants or descendants of migrants, whose identity and sense of belonging have been shaped by their migration experience and background". For this review, a more specific definition of diaspora has been used which considers it as "a network of culturally or nationally affiliated individuals with some common background, living outside of the borders of their perceived native land".[3] In the post-socialist context to which Moldova belongs, the diaspora can be broadly divided into two groups, the "old" and the "new". These two groups within the diaspora have different structures and engage differently with their homeland, each having formed distinct attitudes about and relations with Moldova.

In this division, the "old" diaspora refers to those Moldovans who emigrated prior to the collapse of the socialist system and have integrated into their chosen foreign society as well as their descendants who have grown up there. This group still retain a connection to their original identity but is the more likely of the two to be professionally established. In contrast, the "new" diaspora is comprised of individuals who left Moldova following

its independence in the early 1990s. While many in this group permanently emigrated, a significant number have also moved abroad temporarily for work or other economic reasons. The average economic circumstances of this group, especially those who left in the first few years after independence, is relatively modest when compared to the "old" group. The differences between the two groups are further compounded by variance in the migrants' educational, professional and other socioeconomic factors[4].

The "old" diaspora refers to Moldovans who emigrated prior to the collapse of the socialist system and the "new" diaspora comprises individuals who left Moldova following independence in the early 1990s.

With the rapid rise in emigrant numbers following independence, Moldova's diaspora is generally seen to be relatively young[5]. It is estimated that close to 1.2 million, or approximately one-third of Moldova's population, currently resides abroad, an estimate that includes Moldova's "old" diaspora.

Following independence in the early 1990s, there was a substantial wave of emigration from Moldova, a process that ebbed over the following decade. However, emigration has again increased since the early 2000s, partly driven by closer integration with the EU and in line with patterns seen in other Central and Eastern Europe (CEE) and certain former Soviet Union (FSU) economies. The drivers of Moldovan emigration have ranged from political uncertainty and humanitarian issues to limited economic opportunities and social security.

The Moldovan diaspora consists of labour migrants as well as permanent emigrants that generally include those more highly skilled in STEM, medicine and other knowledge-intensive occupations

According to the IOM, Moldovan emigrants can be divided into three groups. The first group is comprised of short-term labour migrants travelling for seasonal work to the Commonwealth of Independent States (CIS), mainly Russia (close to 55 per cent of all migrants in 2014), Poland and other European countries. These migrants are part of a circular migration process that sees them frequently returning to Moldova in interim periods between employment contracts abroad.

Longer-term labour migrants to the European Union (EU) could play an important role in catalysing innovative entrepreneurship back home due to their affluence and business orientation.

The second group consists of longer-term labour migrants to the European Union (EU), primarily Italy, who tend to stay beyond the requirements of their seasonal employment. This group is more affluent and business-oriented than the first but still maintain an active presence in Moldovan society and its real estate market, suggesting they entertain the idea of eventually resettling in their homeland. At the outset of the COVID-19 pandemic, the majority of such migrants in the EU returned to Moldova (the IOM estimates that between 50,000 and 60,000 returned) as the ensuing economic shutdown paralysed their host States. Although it must be noted that many returned with plans to resume their employment in the EU in the medium term. For this study, this group may likely turn out to be the most important of the three in fostering entrepreneurial ambitions and catalysing innovative entrepreneurship back in Moldova. However, this will require establishing the right mechanisms and procedures to facilitate and guide the process.

Finally, the third group, of around 350,000 people, is comprised of individuals more securely established abroad with no immediate intention of returning to Moldova, these form the permanent diaspora. The geographic range of this group comprises approximately 100,000 individuals residing in Israel (Moldovans and those with an ethnic Jewish background), the U.S. and Canada (50,000 each), with those remaining spread throughout Italy, Russia, Ukraine, Turkey and several other countries.

Permanent diaspora is largely comprised of highly-skilled individuals employed in knowledge-intensive occupations and having acquired formal residency abroad while maintaining cultural affiliation with their homeland.

A fact-finding exercise for this report revealed two important characteristics of this third group. First, the group is largely comprised of highly-skilled individuals employed in occupations that most frequently involve engineering, medicine, the sciences and arts. The second finding was that majority of the individuals in this group have acquired more formal types of residency (i.e., citizenship), thus more fully and permanently integrating with their host States. Nevertheless, in the context of this report, this group continues to display a significant trait, a remaining cultural affiliation with their homeland. This means that many of the traits of the "old" group in the diaspora, as discussed above, apply to this group.

To be effective, policies to engage with the Moldovan diaspora should reflect its diversity and aim to build trust.

While it is difficult to assess the diaspora's true potential, it is reasonable to conclude that if Moldova's expatriate community could be sufficiently mobilized and targeted it would be an important factor in Moldova's broader strategy for innovation-driven sustainable development. However, viewing the diaspora as homogenous would fail to recognize that it is made up of over a million individuals with differences that range from nuanced to unequivocal. These differences should be properly accounted for and addressed in programmes designed to engage with the diaspora, particularly with regard to expatriates' trust in the home country's institutional capacities. The next section provides some further detail on Moldova's emigrant profile and reviews some representative initiatives implemented in recent years to engage with the diaspora.

Moldova's migrant profile and the country's connection with its diaspora

Moldovans, typically migrate for economic reasons, plan to return once their socio-economic status improves and make significant remittances back home while they are abroad.

Moldova's migrant profile has been extensively analysed by both national and international agencies, such as the IOM[6]. In this chapter, several aspects of this analysis are highlighted which are particularly relevant to Moldova's efforts to leverage its diaspora for innovation-driven sustainable development.

Many Moldovan emigrants hold Romanian citizenship, posing challenges for the accurate assessment of Moldova's diaspora.

On the whole, Moldovan emigration has economic roots caused by a weak domestic labour market and low wages. A substantial proportion of Moldovan emigrants holds Romanian citizenship, allowing them to freely enter and seek employment in the EU. However, while providing opportunities for better employment, this dual citizenship status often complicates efforts to accurately assess many of the diaspora's key details.

Consistent with the diaspora's division into the three groups identified in the preceding section, the majority of Moldovan emigrants intend to return to Moldova at some point. This is an example of circular migration common for Moldova. Emigrants' decisions about how long they remain abroad are dependent on the degree to which their socio-economic status (e.g., income and savings) improves during their stay. This is a key determinant as the majority of circular migrants plan to open businesses in their communities upon their return to Moldova, which often requires a certain level of financial capability.

However, even before members of the diaspora return, their remittances contribute significantly to many Moldovan households, so that in 2020, approximately 16.3 per cent of Moldova's gross domestic product (GDP) came from the diaspora[7]. The importance of

this contribution is reflected in recent World Bank estimates that show Moldova as one of the top 20 recipient countries of such remittances (Figure 6.1). It is also notable that the percentage contribution of Moldova's diaspora to GDP is higher than many other countries in the region, such as Armenia, Georgia and Ukraine, all of which are known to have large diasporas.

With many intending to return to Moldova, emigrants also contribute significantly to Moldova's economy through remittances that are among the highest in the region.

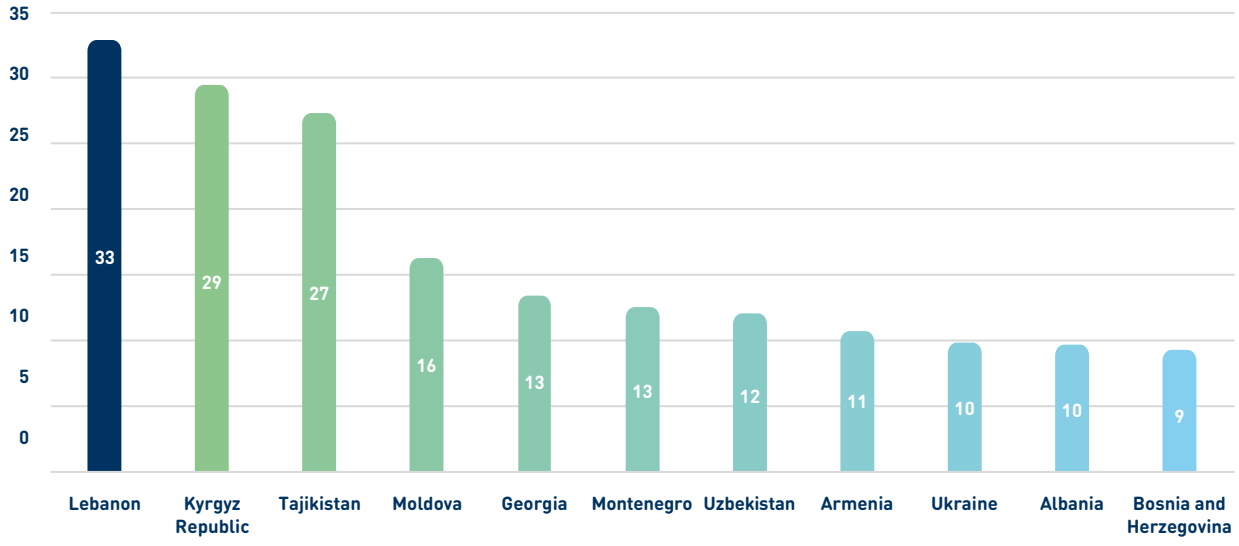
The decision on how much money to transfer back home is based on individual assessments of the recipient's needs. One impediment to the free flow of such transfers is the lack of trust in Moldova's financial system.

Moldovan emigrants are relatively well-integrated into existing diaspora networks in their host States and maintain strong connections to their homeland, often through Hometown Associations.

In their host States, Moldovan migrants tend to integrate within existent diasporic social networks as this helps them to culturally adapt and find employment[8]. Some of these networks also maintain close contacts with the Hometown Associations (HTA) located in Moldova and the various host States. These HTAs, initially established with UNDP support, are focused on facilitating diaspora-based development within Moldova. This is done through HTAs' efforts to connect Moldovans who live outside of a specific community, either within Moldova or abroad, and who are still interested in contributing to this community's development. This connection to regional developments at home is a particularly distinctive feature of Moldova's migration dynamic.

Moldova's circular migration process is significantly fueled by the large numbers of highly-skilled individuals (engineers, medical doctors, information technology (IT) specialists, teachers, agronomists, etc.) who emigrate each year. Unsurprisingly, this creates human

Figure 6.1 · Diaspora remittances as a percentage of GDP in 2020
(Selected countries)



Source: World Bank-Migration and Remittances Data (2021).
Note: Selected countries with diaspora remittances estimated to contribute at least 9.0 per cent to GDP.

Brain drain, or the outflow of highly-skilled professionals from a developing country, is a pronounced phenomenon in Moldova.

capital development challenges and is detrimental to Moldova's private sector which can absorb more of these skilled workers than it can source domestically. The volatile economy, an unstable institutional environment, scarce State funding of research and development (R&D) and depleted human capital capacity have led to such outflows and contributed to the formation of large sub-groups within the diaspora that have scientific and business expertise. Colloquially, this outflow of highly-skilled or educated human capital, usually from a developing economy, is often referred to as 'brain drain' and is an especially pronounced phenomenon in the case of Moldova.

Highly-skilled Moldovan emigrants are often employed in low-skilled jobs, with significant differences between genders driven by traditional roles

As some evidence shows[9], as few as 21.7 per cent of Moldovan migrants to the EU were employed in the same profession as they were in Moldova. More recent survey results[10] point to the persistent "erosion of professional qualifications" as most of Moldova's educated emigrants are employed in low-skilled occupations. There is a shared concern among researchers that such a trend may lead to the loss of such migrants' skills and qualifications, meaning 'brain drain' in some cases evolves into 'brain waste'. There is also a notable gender divide in this regard. Irrespective of their qualifications, most men are offered jobs and work in the constructionor transport sectors abroad; while women work predominantly in households (e.g., caregivers), social assistance, and healthcare.

Highly-skilled members of the diaspora frequently have to invest in additional educational qualifications in their host State to secure employment more aligned to their skills and experience

Moldovans working in highly-skilled occupations abroad have almost always had to invest time, effort and financial resources to complement their Moldovan qualifications, e.g. by undertaking professional or academic programmes in their host State[11]. These investments are seen as partially contributing to the low likelihood of these highly-skilled emigrants returning to Moldova. In addition, close to 22 per cent of migrants with higher education qualifications indicated a desire to go abroad permanently, according to the latest survey data[12]. Overall, despite government policy efforts, potential migration, defined as the "general desire to emigrate in the future", remains high in Moldova, representing an ongoing policy challenge.

Trust is a key factor for diaspora engagement, along with adequate infrastructure to connect with the homeland, both of which have much room for improvement.

One of the common regrets expressed during the fact-finding interviews conducted for this report was the lack of trust between the highly-skilled diaspora members and the home country`s public sector institutions. This factor contributes to similar reservations revealed during the IOM's mapping exercise of all Moldovans living abroad. According to the IOM study, highly-skilled Moldovans working in the field in which they are trained cited the lack of facilitating infrastructure to connect with counterparts in Moldova, cumbersome administrative requirements and even more complex international transaction processes as the primary deterrents from engaging more closely with their homeland. These issues were particularly salient with members of the diaspora who were involved with science and research. Nevertheless, there is still a strong, overall interest from the diaspora to contribute to Moldova's development, either on an occasional or regular basis. This means that further significant benefits can be gained by providing well-delineated avenues for cross-border professional interaction[13].

Moldova has successfully gained diverse experience via its policies that engage with its diaspora, often with significant donor support

Moldova has been quite active with its diaspora outreach over the past five years. More specifically, partnerships with diaspora social networks and HTAs have resulted in tangibly successful projects, with Table 6.1 summarizing three of the most prominent previous and present initiatives being.

The two that stand out as prime examples of the effective involvement of the diaspora are the PARE 1+1 and the "Migration and Local Development" (MiDL) projects.

Certain initiatives, such as the UNDP's MiDL project, positively impacted diaspora engagement in local development, strengthening links between Moldovans abroad and their hometowns while also piloting an informal skills recognition mechanism

Since 2019, the MiDL project initiated by the UNDP in 2015 led to launching of a new DAR 1+3 programme under the DRB. DAR 1+3 includes the cooperation between the government, local public authorities, development partners, and diaspora or hometown associations[14]. The project is designed to ensure funding for initiatives of a socio-economic nature to tackle local development challenges, with funding coming from the diaspora (at least 10 per cent), the Moldovan Government (at least 50 per cent), local public authorities (at least 10 per cent) and development partners (no limit). The programme has already held two calls for projects, with the latest taking place early 2021[15].

Early in its implementation, the MiDL project helped to import diaspora expertise to assist at the micro-regional governance and economic policy levels in Moldova. More specifically, participating regional administrations assigned focal points to maintain connections with corresponding diaspora HTAs abroad. The UNDP refers to this process as "mainstreaming migration", a practice that has led to local administrations being more

The MiDL project managed to involve more than 10,000 diaspora members in local development initiatives, bringing diaspora expertise and funds to serve local needs.

Box 6.1

Attracting and using remittances for economic development: Moldova's Programme for Attracting Remittances into the Economy

This programme, first implemented by the Organization for the Development of the Small and Medium Enterprises Sector (ODIMM) in 2011, has helped connect migrants' expertise to local small businesses and entrepreneurial training initiatives and fostering the option for members of the diaspora to jointly establish a business with another family member or a friend living in Moldova with help from the government (on a co-funding basis). The programme channels remittances towards small and medium-sized enterprise development in Moldova's agriculture, industrial and services sectors. Between 2011 and 2017 over 1100 projects were implemented with initial investments coming from the emmigrants' remittances which attracted additional funding from other investors and led to significant job growth throughout Moldova. The programme has benefited from both Moldovan Government and EU financial support and continues to foster the development of entrepreneurial skills among geographically widespread emigrants as well as local remittance recipients[a].

Source: The UNECE, based on information from the ODIMM.

[a] For an early update on success of the PARE 1 + 1 see https://www.odimm.md/en/press/press-releases/4548-one-billion-lei-in-the-country-s-economy-through-pare-1-1

Table 6.1 Moldova's diaspora engagement initiatives, 2010–2017

Programme	Led by	Target group/ goals	Key achievements	Extensions and status
Temporary Return of Scientists[a]	IOM-led but run jointly with the Academy of Science of Moldova (ASM); implemented in the early 2010s[b]	Scientists who left in the early 1990s (the "old" diaspora).	This programme led to the establishment of a network of Moldovan scientists abroad. It offered small grants for up to two-week stays in Moldova to help scientists re-establish collaborative efforts with Moldovan academic institutions. The programme also encouraged the transfer of innovative and technological information, joint projects with international research institutions as well as facilitating teaching efforts and project implementation. Approximately 40 small cooperation projects and several teaching courses were developed under this programme.	A subprogramme focused on young scholars, facilitating their return from abroad. This initiative assisted almost 200 returning graduates to find employment, competitive pay adjustment, counselling and networking. While the programme was phased out when funding from the EU ceased, the ASM has continued its efforts through the already established networks.
Diaspora Engagement Hub[c]	Led by the DRB and IOM; launched in 2013	This initiative offers thematic grants intended for individual Moldovans and associations based abroad.	There are seven priority themes: • Diaspora Professionals Returning – small grants to encourage the exchange of professional experience to stimulate Moldova's scientific and innovative development; • Diaspora Women Empowerment – grants designed to support the civic, legal and economic status of Moldovan women in the diaspora and those returning; • Diaspora Crowdfunding Projects – a mechanism by which small grants are coordinated to meet Moldova's regional development needs. This is a grant-matching initiative based on minimum-amount targets for projects which have successfully carried out an initial fundraising campaign; • Thematic Regional Partnerships – grants intended for diaspora associations located in at least two different countries for socio-economic, health, educational and community development projects carried out in one of Moldova's regions; • Diaspora Innovative Projects – small grants to diaspora researchers on the condition that the project benefits Moldova through transfers of knowledge and best practices; • Diaspora Excellence Groups – a programme encouraging collaboration between government agencies and diaspora experts in the critical areas of socio-economic development of Moldova. It is reviewed separately below; • Subprogramme for Diaspora Youth – a range of educational and cultural youth programmes, including summer camps.	To date, 110 grants have been disbursed. Contingent on funding from the Swiss Development Cooperation Agency (SDC)[d].

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Table 6.1 **Moldova's diaspora engagement initiatives, 2010–2017 (Concluded)**

Programme	Led by	Target group/ goals	Key achievements	Extensions and status
Diaspora Excellence Groups[e]	Led by the IOM's Moldova office but jointly implemented in 2017 by the IOM, Moldova's Prime Minister's Office and the DRB.	The programme's main focus was to draw on the diaspora's expertise for policymaking, governance and lawmaking involving Moldova's relevant government structures.	The project generated some interest from Moldova's "old" scientific diaspora and saw the implementation of several substantial proposals for scientific and research centres. Diaspora Excellence Groups fostered development in Moldova's education and research sectors, establishing links with innovative thinkers within the diaspora and encouraging them to temporarily return home for participation in various activities.	The project was implemented by the DRB but remained a small-scale undertaking despite having some potential to do more.

Source: The UNECE, based on fact-finding data and publicly available information on the programmes.
[a] For more information, please see the Extended Migration Profile of the Republic of Moldova 2010–2015, IOM, https://publications.iom.int/system/files/pdf/emp_moldova_2010_2015.pdf
[b] The complete name of the initiative is "Addressing Brain Drain through Temporary Return of Scientists – Moldovan Expatriates and Young Researchers from Abroad – to Strengthen Moldova as a Research and Development Centre and to Promote Temporary and Permanent Returns and Transfer of Skills." For the formal Call for Proposals for the 2014-2015 round, see ASM webpage http://cpi.asm.md/?p=5365&lang=en
[c] For additional details on the Diaspora Engagement Hub see https://brd.gov.md/ro/content/diaspora-engagement-hub-1
[d] The project received initial financial support from IOM Moldova
[e] For additional background information on the Diaspora Excellence Groups see https://cancelaria.gov.md/en/content/seven-highly-qualified-experts-moldovas-diaspora-be-leaders-diasporas-excellence-groups

open to input from the diaspora while providing Moldovans abroad a meaningful and hands-on mechanism to reconnect with their home communities. The resulting active participation of the HTAs in spearheading business, infrastructure and social improvements in Moldova has resulted in the diaspora being significantly involved, indeed, over 10,000 members of the diaspora have been involved in these developmental improvements across Moldova's regions. The project was successful in harnessing a portion of the diaspora's financial and soft expertise to assist some of the country's lesser developed regions. The second phase of MiDL builds on this initial success, expanding the scope of the project by involving a broader array of HTAs across more of Moldova's regions. The more recently implemented DAR 1+3 project has already led to 42 local projects being undertaken with support from the diaspora, although the COVID-19 pandemic and consequent budgetary reduction mean the medium-term results may be more modest.

The MiDL and DAR 1+3 initiatives have also made significant contributions to the establishment of an informal skills recognition mechanism to minimize the effects of the aforementioned 'brain waste' through recognition of migrants' practical experience abroad to improve their formal employment prospects in Moldova. The mechanism was piloted in the construction and food service sectors, with its operational roll-out now ready for other sectors, such as textiles. This is a significant step towards the successful reintegration of the diaspora's skills and expertise back into Moldova's economy, tackling the problem of deskilling in migrants' original areas of expertise by recognizing newly acquired skills in other sectors.

An informal skills recognition mechanism piloted in Moldova allows for recognition of "informal" skills acquired by emigrants abroad, facilitating their formal employment in Moldova.

Despite their success, most programmes focused on diaspora engagement face sustainability issues due to a lack of long-term funding and the diaspora's limited trust in government initiatives

Limited policy experience, funds and diaspora trust in state-led initiatives are among the key challenges to effective policy implementation.

Despite the challenges it faces, Moldova is continuing to pursue a path of dynamic diaspora engagement. A notable positive feature of both the existing and planned programmes is their inclusivity of all Moldovans living abroad in a wide array of initiatives that range from having a rather general developmental nature to those that are professionally or purpose-specific. Despite this solid foundation, Moldova faces three critical problems that prevent it from transforming these initial efforts into a sustainable innovative development model that brings significant and widespread benefits throughout the country. These three problems are briefly detailed as follows.

1. A typical feature of the described programmes is the limited timeline of operations as well as their limited (often, pilot stage) outreach campaigns. While several modalities of communication with the diaspora are active, often relying on new technological capabilities and social media, the shared sentiment that emerged from the fact-finding mission and diaspora mapping studies is that the outreach campaigns would be more effective if they could be strengthened.
2. Most of the financial support for diaspora-engagement programmes is both limited and directly dependent on the partnering foreign development agency or foreign governmental entity (e.g., the EU) which work with multilateral groups in Moldova. In this regard, programmes such as PARE 1+1 may have the greatest potential for future organic expansion of Moldova's strategic engagement with its diaspora.
3. Finally, there is a significant lack of diaspora trust in government-driven development solutions. This wariness has been shaped by a range of factors internal to Moldova and those related to diaspora functions (including, identity preservation) in host States. Divergent mechanisms and means of policy implementation between the diaspora and the Moldovan Government could be driving this disconnect. As an example, one source of this lack of trust may be outdated administrative processes in the public administration, or cumbersome requirements for international financial transactions and other regulatory complications.

The next section will briefly synthesize the findings from an examination of a large body of literature on the diaspora's innovative effects, 'brain gain' as well as some representative cross-country initiatives that actively engage with national diasporas and that are relevant to Moldova's specific context that was outlined above.

Turning 'brain drain' into 'brain gain' - examples of successful diaspora engagement

Moldova tapping into its diaspora's economic and innovative potential is best viewed in the context of the global experience, but also of the small open post-socialist economies[16]. One of the main processes in this regard was the formalization of the diaspora in the late 20th century in China, India, Ireland, Israel, Korea later recognized as a state-led effort of reversing 'brain drain' and converting it into 'brain gain', i.e. enhancing the intellectual capital of Moldova through the immigration of highly skilled individuals, that went beyond simply receiving remittances.

The diaspora's remittances, despite their considerable contribution to Moldova's GDP, cannot singlehandedly drive structural economic transformation.

Remittances, as a prime example of a diaspora's participation in its homeland's development, can provide improvements for the receiving individuals' well-being but cannot yield structural economic transformation at the national level. It is hard to argue that remittances are a reliable source of sustainable economic growth given their individualized and ad hoc nature as well as their dependence on the host State's economic cycle[17]. In Moldova, even with its wide range of diaspora engagement projects, the positive impacts of remittances seem to be highly localized without any noteworthy transformational effect on the economy's macrostructure[18].

Similarly, most of the diaspora's engagement in terms of knowledge and skill transfers remains largely individual driven. What is lacking in this environment is a structural framework that could systematically harness and coordinate such individual behaviour to be a meaningful contributor to the common good[19] of broader macroeconomic development.

Diaspora engagement with knowledge and skills transfers has been largely on a case-by-case basis with limited systemic impact.

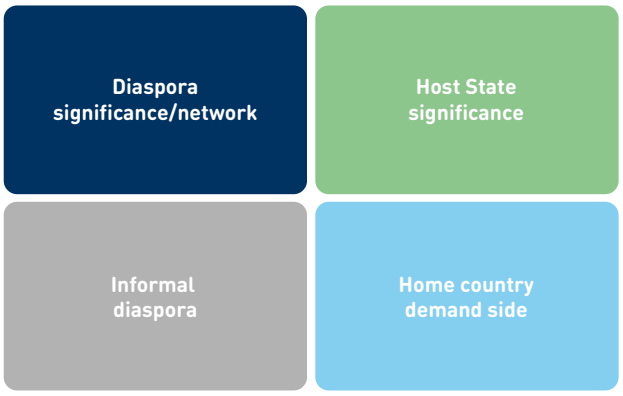
The members of the entrepreneurial diaspora play a very important role in enhancing the reputation of their homeland's economy. The IndUS Entrepreneur (TiE) is an example of a diaspora-created organization that, since its creation by the Indian diaspora in 1992, has spread across the world focusing on mentoring, networking, education, funding, and incubation[20]. The organization has helped to raise India's recognition across global value chains and triggered structural transformations in India's economy as leading multinational corporations invested in the country. The Indian diaspora has brought diverse new skills, human-, social- and financial capital as well as foreign direct investment (FDI) to the national economy while also providing access to previously inaccessible markets[21]. At the same time, India's IT sector offered an incentive to highly-skilled diaspora entrepreneurs for mobility (back to India), enhanced networking, and deeper engagement with the homeland.

While India's example demonstrates the positive impacts a diaspora can have on a country`s development, this cannot be fully transferred to a small and still developing post-socialist country such as Moldova for several reasons[22]. Highly-skilled professionals generally migrate due to financial and professional "push" factors (e.g., limited career advancement, unsatisfactory working conditions and inadequate equipment) and often return to their home country for very personal reasons (e.g., homesickness and ageing or ailing family members)[23] [24]. For the small (in terms of geography, population and GDP) Moldovan economy, even a modest-sized and intermittent outflow of skilled and experienced professionals can have palpable detrimental consequences for the country's human capital resources and social inequalities. Furthermore, while it is a positive for the economy, the eventual return of even the vast majority of these professionals is often not sufficient to jump-start innovative development.

The return of Moldovan professionals from abroad would be insufficient to jumpstart innovation and a strategic framework is needed to tap into the potential for knowledge and skills transfer between the diaspora and Moldova.

The diaspora has much to offer in terms of knowledge and technology transfers to the home economy, but a strategic framework is needed to tap into this potential. One example that can be noted in this regard is the specific case of Moldova's emigrant researchers and scientists, who generally voice an eagerness to contribute to the country's development while abroad[25]. However, no clear diaspora policy is in place that establishes a transparent and effective mechanism to systematically take advantage of this desire.

Figure 6.2 · Four factors of significance in a diaspora's capacity to transfer knowledge and technology



Source: The UNECE, based on Kapur (2001).

As Figure 6.2 shows, it is the combination of several factors that make diaspora`s significance for such transfers important: diaspora networks, a host State's relative significance in the global economy, informal diasporas that are often influential in the home country's weaker institutional environment and the demand side in the home country (e.g., clearly defined strategy outlining infrastructure for diaspora engagement).

Box 6.2 offers a curated summary of select case studies from across the world that focus on efforts to integrate a diaspora's human capital with its home country. Some of the initiatives arose organically from the diaspora while others were established by the home country's Government, however, the activities undertaken from these two sources eventually start to work together[26]. In addition, the featured experience highlights that efficient and successful connections are not solely built on tangible frameworks or incentives but also on strong, albeit intangible, cultural links between a homeland and its diaspora which are worth nurturing.

Box 6.2 Select examples of diaspora engagement for innovative-driven sustainable development in the homeland

Armenia – the **Foundation for Armenian Science and Technology (FAST)** was established in 2017 by philanthropists from Armenia's "old" diaspora to harness the scientific, technological and financial resources of the Armenian diaspora and promote Armenia on the global innovation map. FAST focuses on encouraging innovative members of the diaspora to partner with like-minded enterprises in Armenia to advance high-end commercially viable and globally competitive solutions in the areas of IT, artificial intelligence, robotics, biotechnology and manufacturing. The group actively cooperates with academic, government and industry stakeholders[a].

Croatia - the **Unity through Knowledge Fund (UKF)** was established in 2017 by the Ministry of Science and Education of the Republic of Croatia, the UKF has funded close to 100 scientific research projects. The fund is jointly financed by the Croatian Government and the World Bank. It cooperates with Croatian scientists living abroad and actively promotes scientific innovation and the implementation of joint research programmes with young scholars. The UKF has also been successful, in part thanks to the expatriate network, in building cooperative relations with leading research groups abroad and developing meaningful links between industry and academia[b].

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Box 6.2 Select examples of diaspora engagement for innovative-driven sustainable development in the homeland (Concluded)

Greece – the **Greek Diaspora Fellowship Program (GDFP)** is a scholarly exchange programme connecting Greek universities to scholars in the Greek (and Cypriot) diaspora in the U.S. and Canada. The GDFP is founded in 2016 by the Stavros Niarchos Foundation (administered jointly with the Fullbright Foundation in Greece) and works similar to other online scholarly or employment matching programmes – with a host making a project request and diaspora scholars submitting applications. The programme seeks to support the professional development of Greek diaspora scholars and Greek higher educational institutions in research collaboration, graduate student training, curriculum co-development. The long-term goal of the GDFP is that its efforts will lead to strong institutional connections internationalizing Greece's science and technology sector through innovation in education and research. Progress towards this long-term goal is supported by an active and growing alumni network that helps sustain the project's viability and relevance[c].

Ireland – the **Emigrant Support Programme** is an example of a government-sponsored programme (established in 2004) that acts indirectly to maintain close links with the 70 million strong Irish diaspora. The programme funds cultural and heritage projects across regions with large ethnic Irish populations (e.g., North America, Australia and Europe) and is part of the country's Global Irish diaspora strategy. The stated purpose of the programme is "to fund projects that will have a clear and identifiable impact on supporting and building global Irish communities". Such indirect methods of engaging with a diaspora may be equally effective in drawing its interest towards homeland innovative development needs. The reason for this is the sense of trust and connection that evolves through frequent cultural and professional interactions between individuals in the diaspora and their ancestral homeland, even if this occurs via proxy organizations. This is another example of a country appealing to its diverse diaspora by channelling the positive spillover effects into the homeland economy from various diaspora-related innovative initiatives[d].

The EU - **European Mobilisation for Entrepreneurship in Africa (MEETAfrica)** is an initiative sponsored by the European Union and France that offers competitive technical support to highly performing innovative startups led by young members of the African diaspora that live in France and Germany that implement projects in the countries of their origin[e].

Portugal - **Programa Regressar** was created by the Portuguese Government in 2019 to create the best possible supporting framework for members of the diaspora, especially the "old" diaspora, as well as their descendants and relatives, to return to Portugal. The programme offers online assistance to (former) diaspora members with finding employment as well as advisory support, training, financial and other support services. Importantly, the initiative is highly-inclusive as it encourages both low- and highly-skilled migrants to return and coordinates its activities with the Portuguese consulates around the globe[f].

Source: The UNECE, based on publicly available information on the programmes.
[a] For more information on Armenian FAST, see https://fast.foundation/en/about-us
[b] For more information on the Croatian Unity through Knowledge Fund, see http://www.ukf.hr/
[c] For more information on Greek Diaspora Fellowship Programme, see https://www.iie.org/programs/greek-diaspora-fellowship-program
[d] For more information on the Irish Emigrant Support Programme, see https://www.dfa.ie/global-irish/support-overseas/emigrant-support-programme/
[e] For more information on the European Mobilisation for Entrepreneurship in Africa programme, see https://meetafrica.fr
[f] For more information on the Portuguese Programma Regressar, see https://www.programaregressar.gov.pt/

Support from international organizations and the private sector is crucial to the roll-out of diaspora engagement initiatives as these typically require substantial investments that the public sector alone cannot provide

The interplay between public and private domestic participants, with a role of varying scope for international organizations, is important for the success of diaspora-engagement initiatives. For example, in addition to Government initiatives in Armenia, an organization called Repat Armenia is actively helping individual diaspora members and their families to resettle and reintegrate within Armenia. In some areas this has yielded remarkable results with these new arrivals remodelling Armenia's entire service and hospitality sectors, making the country more internationally competitive and putting it on the global tourism map, with other areas such, as the light textiles and agricultural industries, also seeing notable advances[27].

Countries such as Ireland, Portugal, Tunisia and Denmark have embraced local government-led initiatives and incentives that range from financial assistance and tax breaks to community and business reintegration that prioritizes entrepreneurial and

In the Philippines, Scotland, Estonia and Ireland, effective diaspora engagement required innovation on the side of the public authorities to meet the demands of today's complex economic and social realities.

innovative projects from the diaspora. For example, in 2013 the Philippines, which is at the forefront of the world's innovative migration efforts, launched a one-stop online portal called BaLinkBayan to engage with its diaspora[28]. The portal, a part of the diaspora development programme of the Commission on Filipinos Overseas, offers an integrated and unique platform to help re-engage entrepreneurially-minded members of the diaspora with their homeland. In this regard, the availability and increasing sophistication of e-governance services are important for engaging with a diaspora efficiently through digital spaces free of red tape (e.g., Estonia, Ireland, Tunisia)[29]. The GlobalScot is another example of an online network community maintained by the Scottish Government since 2001 that is designed to leverage global connections to support domestic business and promote economic growth[30].

As can be seen from the above-cited examples, the proliferation of diaspora-engaging initiatives has been both global and quite diverse. In their efforts to establish and sustain stronger bonds, governments are forced to innovate and comply with the demands of today's globalized economic reality. We can reasonably expect that since so much work has moved online following the upheavals of the COVID-19 pandemic, including that of highly-skilled workers, the multiplicity of efforts will continue to increase. While this may lead to more systemic approaches to harnessing a diaspora's innovative potential for homeland development, the challenge for each Government will be to effectively maintain the coordination of such approaches as engagement with its diaspora grows.

Despite gaps in resources and infrastructure for diaspora engagement, Moldova can build further policy efforts on past and current engagement initiatives and current active diaspora participation in development initiatives.

Many of the individual cases mentioned above highlight the benefits of providing a strong role for the diaspora in promoting homeland innovation and economic development, however, in the case of Moldova, a systemic view of diaspora engagement is still needed. Progress in this regard is constrained by limited resources and the needed infrastructure as well as the relatively depleted human capital. Nevertheless, Moldova has some strategic advantages over a number of its Central and Eastern Europe (CEE) and former Soviet Union (FSU) neighbours thanks to its existing robust set of diaspora engagement projects and the high participation rate of Moldovans living abroad in improving their homeland.

The next section offers some policy recommendations which build on Moldova`s success and experience thus far in running diaspora engagement programmes. These suggestions are designed to provide tailored policy guidance on how to further tap into the diaspora's potential to deliver innovative-driven sustainable development for Moldova.

Towards an enhanced role for the Moldovan diaspora in innovation-driven sustainable development

This chapter advances a set of five policy recommendations that are offered to guide government efforts towards further improving the diaspora's engagement in innovation-driven sustainable development in Moldova. This is done with all due appreciation for Moldova's already well-developed portfolio of diaspora programmes along with encouragement to also periodically review and update the country's Diaspora Strategy. The implementation of each recommendation may be done gradually or in phases and involve public-private cooperation frameworks and with a substantial role played by the DRB in driving future processes forward.

The ultimate goal is to develop a closer, more meaningful and pro-active framework of diaspora engagement in Moldova's innovative economic development. The optimal policy approach is one based on inclusiveness, that takes into account Moldova`s socio-economic and sustainable development objectives and addresses the three key limitations discussed above, namely programme durations, financing and issues of trust.

Building a nuanced understanding of the composition, location, professions, networks and skills of Moldovans living abroad

A voluntary registry of Moldovans living abroad could meaningfully complement data collection exercises to detail diaspora composition.

Establishing a voluntary database or registry of professionals living abroad but are still culturally or in some other way affiliated with Moldova would provide a better understanding of and links to the diaspora and help harnessing the potential of informal diaspora networks *(Recommendation 6.1.1)*. This could be done through censuses and other surveys to help build a nuanced understanding of the composition, location, professions, networks and skills of Moldovans living abroad *(Recommendation 6.1.3)*. Undertaking such an endeavour would also offer an opportunity to match project and employment opportunities with individuals in Moldova as well as those who are part of the diaspora. Having more detailed information on Moldovans living abroad may help to identify concrete channels to reconnect with the diaspora on a more permanent basis. Census data may also be incorporated as a component of a larger project within the UNDP's Transfer of Knowledge through Expatriate Nationals (TOKTEN) programme. This may potentially allow some costs to be defrayed and give broader reach across expatriate communities. At the same time, connecting with the UNDP's multilateral initiative may result in positive network and learning synergies from other countries, which would likely prove to be a key resource to fine-tune a pro-active diaspora integration strategy.

Alongside gathering census and survey data, a set of institutions and contact points should be identified or established and tasked with developing and maintaining links with the diaspora's scientific and professional associations in particular *(Recommendation 6.1.2)*. These institutions would ideally include universities, public research organizations (PROs), HTAs, local governments, and so forth.

Consolidating, leveraging and scaling up existing capacities and mechanisms to reflect international best practices for diaspora engagement while drawing and expanding on Moldova's current and past experiences

To engage a large proportion of the diaspora in innovation within Moldova, it is important to implement targeted projects within the limits of existing policy capacity and build on experience to progressively develop the needed infrastructure for future large-scale initiatives.

Integrating diaspora engagement in key policy documents and broadening the scope for pilot diaspora engagement initiatives among potential sector or regional hubs would help deliver better policy outcomes.

The diaspora's potential contribution as a driver for innovative development is invaluable and, as such, the diaspora will ideally feature prominently in the national development strategy *(Recommendation 6.2.1)*. This is best achieved by implementing concrete measures specifically designed to tap into this potential, such as programmes on skills development and recognition for labour migrants, targeted cooperation with the scientific segments of the diaspora and so forth. Thus, the MiDL and DAR 1+3 projects (or a new but similar initiative) can be further enhanced to offer the main stakeholders additional autonomy in decision making at the sectoral and regional levels while remaining aligned to Moldova's national economic development objectives *(Recommendation 6.2.2)*.

This coordination between stakeholders and national objectives may be facilitated with HTAs and local communities identifying needs consistent with the national long-term development programme.

Furthermore, it may be prudent to consider creating short-term opportunities that build long-term academic and professional connections (e.g., short term science trips and academic exchanges) *(Recommendation 6.2.3)* with young adults as the primary focal point (e.g., similar to the BirthRight Israel and BirthRight Armenia programmes; teaching abroad initiatives). The logistical aspects aside, financing can come, at least in part, from cooperation with high-net-worth individuals in the Moldovan diaspora. This recommendation seeks to make practical extensions to already ongoing initiatives such as DAR 1+3, Engagement Hub and others, as noted above. Enhancing these programmes in this manner may also contribute to implementing Recommendation 6.2.2, as expanding academic networks to include international institutions through the diaspora can support young-researcher programmes and add an international mobility aspect.

Developing and maintaining flexible engagement infrastructure to interact with the diaspora and foster synergies between diaspora development proposals and Moldova's needs

The increasing heterogeneity of development proposals that seek to partner the diaspora and Moldova's development needs requires a flexible matching mechanism for such a partnership to work. As a starting point, existing crowdfunding and other initiatives can be further enhanced to establish more direct links between Moldova's scientific diaspora and potential investors, with stakeholders directly involved in innovative developments on the ground. Efforts here could contribute to enhanced FDI in the local economy to promote knowledge and technology transfers as well as financial resources. The Diaspora Excellence Groups and Diaspora Engagement Hub programmes are already suitable foundations from which larger-scale efforts can be made. The caveat for success is to have new and adequately financed initiatives supported by an ongoing (non-expiring) platform.

An online diaspora engagement portal could offer direct connections and communication channels between the diaspora and Moldova-based participants, matching key diaspora competencies with domestic needs.

A low-cost and tangible deliverable may be an online diaspora engagement portal that would offer direct communication opportunities between the diaspora and stakeholders in Moldova *(Recommendation 6.3.1)*. The portal[31] would match diaspora members' key competencies with domestic needs and facilitate the formation of well-matched teams of researchers and professionals. It could also be easily extended to larger scale entrepreneurial projects (as is already done in Moldova to some extent). The portal could provide real-time information on individual project needs with the financial, technological, skills and other resources required leading to better talent cooperation, joint business investment and ensuring participation proportionate to the diaspora members' capacities.

Moldova's consulates around the world will also play a leading role in diaspora engagement as not all Moldovan emigrants will have the ability to interact with the internet portal. Therefore, consulates will need staff members to act as contact points (trained by the DRB) with knowledge of the specifics of local diaspora members and groups and can nurture a connection between them and HTAs, academic networks and so forth *(Recommendation 6.3.2)*. Ideally, these consular contacts will also be able to easily identify key competencies within the local diaspora and establish new connections with project partners in Moldova.

Developing linkages between academia in Moldova and Moldovan researchers, scientists and affiliated organizations based abroad through the establishment of a Diaspora Science Group (DSG)

Establishing a sound mechanism for systemic and long-term engagement of the diaspora coordinated through a dedicated body opens new innovative opportunities for Moldova. This mechanism's primary goal will be to promote and foster scientific cooperation between Moldovans living abroad and scientists, researchers and affiliated groups back home. The mechanism would also assist Moldovan scientists based at home or abroad to promote their findings throughout the academic world. The DSG would be this organization, created under the auspices of the DRB but with significant autonomy that grows as the organization matures, returns positive results and secures various third-party funding *(Recommendation 6.4.1)*. This DSG should make a particular effort to connect Moldovan researchers based abroad with young scholars in Moldova to support the latter's education and research efforts through the resulting partnerships with foreign universities and research centres. Naturally, offering financial support, internships, research grants and other means may also become aspects of the DSG's mandate.

DSG would promote and foster scientific cooperation between Moldovans living abroad and scientists, researchers and affiliated groups back home.

The DSG may also offer opportunities for mentorship programmes *(Recommendation 6.4.2)* by partnering and promoting the creation of the professional associations of Moldovan scientists abroad (similar to the Austrian Scientists and Scholars in North America or the Armenian Economic Association)[32]. The DSG could sponsor academic exchange programmes as well as annual gatherings of such associations and unaffiliated diaspora scientists in Moldova or virtually. In addition, the DSG could initiate fellowship programmes, similar to those run by the Greek Diaspora Fellowship Program, which can start small and grow with the organization's success. The fact-finding mission confirmed that diaspora scientists were eager to re-engage with Moldova. The push factors associated with their move abroad, namely income issues, local bureaucracy and uncertainty about project implementation in Moldova, are far less salient for diaspora scientists who assume temporary academic positions with competitive remuneration or who can directly participate in the development of national innovation and diaspora strategies (more on this below).

Introducing mentoring and fellowship programmes could involve partnership with and creation of professional associations of diaspora scientists as well as academic exchange initiatives.

Finally, the DSG's most active mandate would be supporting academic networks in Moldova and the diaspora through the HTAs. The DSG actively participating in high school, universities and vocational education processes will be in a position to identify and match the diaspora's human capital to Moldova's immediate developmental needs. Furthermore, this participation would contribute to both knowledge transfers to young Moldovans and help shape the skillsets of the next generation of workers *(Recommendation 6.4.3)*. Examples of how the DSG could get involved in educational processes may include regular guest speakers from the diaspora or diaspora specialists (co)-teaching courses and contributing to curricula development. Finally, additional benefits could be gained if the DSG worked with the Ministry of Education and Research to develop an efficient process to attribute the equivalency of academic degrees and records of diaspora researchers and educators in line with international standards.

Elaborating policies to maintain contact and enhance trust between the diaspora and Moldova while strategically engaging with Moldovans living abroad to benefit the homeland

Maintaining or re-establishing connections with its diaspora would require Moldova to think strategically about diaspora relations, with a central aim to build trust.

Ideally, Moldova should maintain or re-establish connections with as much of the diaspora as possible. This requires thinking strategically about diaspora relations with the central aim of building further trust. The key role here again falls to the DRB which, while remaining a public-sector entity, would need to acquire greater functional mobility and autonomy than it currently has. It is possible to envision a framework within which the DRB facilitates a closer association between the diaspora and the Moldovan economy by way of alumni networks, engaging the most active segments of the diaspora in elaborating the diaspora innovation strategy and other initiatives *(Recommendation 6.5.1)*. In general terms, the DRB should pro-actively fine-tune and adapt its activities to the multifaceted profile of the diaspora, offering a diverse range of engagement opportunities.

Establishing alumni networks between the diaspora and Moldovan universities, and minimizing overall administrative and financial burden for active diaspora professionals and scientists, would encourage greater knowledge and skills transfer and cooperation.

It is also critical to minimize the administrative burden for both returning Moldovans and diaspora members participating in academic and professional programmes *(Recommendation 6.5.2)*. As mentioned earlier, this recommendation is based on the results of the fact-finding as part of the Review One frequently cited concern was the difficulty and lack of transparency concerning financial matters, especially the requirement that diaspora scientists temporarily active in Moldova needed a local bank account. A related issue is the need to simplify administrative paperwork processes, which range from routine residency documents updates to more complex questions involving multiple citizenships registrations. These processes may be most readily streamlined if diaspora members are registered with the DRB using the diaspora online portal introduced in Recommendation 6.3.1 earlier.

International experience confirms that there is an important cultural component that sustains a diaspora's interest in its homeland, a fact supported by the results of the fact-finding. In this context, the DRB's ongoing programmes for the children of migrants, including summer camps, youth engagement activities and other initiatives, can be redesigned as cultural outreach initiatives. This would help build a long-term connection between the youngest segment of the diaspora and Moldova *(Recommendation 6.5.3)*. If these programmes are sustained and give sufficient attention to the specific needs of the diaspora's various groups, they may lead to stronger cultural bonds. As was the case with the activities of the DSG, this will also likely encourage the diverse and rapidly changing diaspora to have more trust in Moldova's institutions.

Strategic engagement with the diaspora would include clear and transparent policy mechanisms and implementation tools to enhance trust and deepen cooperation.

The results of the fact-finding also revealed that a lack of trust was one of the central explanatory variables for Moldova's wavering connection with its diaspora. Therefore, a clearly outlined diaspora strategy, adopted in consensus with diaspora members (perhaps, during a Diaspora Forum or Diaspora Congress), and an action plan that is consistent with the national development and innovation policy priorities should send a clear signal about Moldova's pragmatic intentions in engaging with its diaspora *(Recommendation 6.5.4)*.

Another positive step, one open to all diaspora members, would be the development of a transparent system to publicly recognize the developmental efforts of individuals and groups from the diaspora *(Recommendation 6.5.5)*. This could serve as a means of further motivating innovative projects and ideas from the diaspora networks. Examples may include but are not limited to, a system of competitive awards for the

most innovative proposals in rural development and public recognition for establishing internationally competitive business ventures or undertaking significant educational activities in Moldova. Being nominated may have various requirements, such as using a certain threshold of local resources or being fully diaspora driven.

Policy Recommendations

The policy recommendations made here build on the already substantial efforts of the Government of Moldova to promote diaspora engagement within Moldova. They explain concrete and achievable steps that can help form closer, more meaningful and more pro-active means of innovative engagement between Moldova and its diaspora. In essence, the keys to success lie in gaining a better understanding of the diaspora's composition and capabilities while building trust so that Moldovans living abroad are eager to strategically engage with the Moldova's ongoing development. In parallel to this, Moldova's institutions and policymakers need to continue to learn from past initiatives and scale up those that worked while also building new and flexible diaspora engagement infrastructure. Doing so provides Moldova with the greater opportunity to leverage the diaspora for innovation-driven sustainable development.

Table 6.2 Summary of policy recommendations on leveraging the diaspora for innovation-led development

Recommendation 6.1: Build a **nuanced understanding** of the composition, location, professions, networks and skills of Moldovans living abroad by systematically collecting, updating and analyzing statistics and surveys.

With no comprehensive data source on its diaspora, Moldova needs to build a solid, thorough, and up-to-date understanding of what Moldovans living abroad could contribute in terms of skills, networks and social capital. This will help Moldova to systematically engage the diaspora with targeted policies designed to facilitate national development.

Actions	Priority	Time-frame	Roles
6.1.1. **Establish a voluntary registry of Moldovans living abroad** to meaningfully complement data collection exercises and detail the diaspora's composition.	②	Short-term	The DRB
6.1.2. **Identify "hub" institutions to serve as engagement platforms,** particularly for the diaspora's science-oriented members (e.g., universities, professional groups, consulates and HTAs).	①	Short-term	The DRB
6.1.3. **Conduct regular diaspora census exercises and other surveys** with an emphasis on detailing skills, profession, networks and fields of interest.	②	Medium-term	The DRB with potential support from the UNDP

Recommendation 6.2: Consolidate, leverage and **scale up existing capacities and mechanisms** so they reflect international best practices for diaspora engagement while drawing and expanding on Moldova's current and past experiences.

Existing engagement mechanisms are not able to systematically utilize the diaspora's potential. To achieve significant and widespread diaspora participation in innovation, it is important to implement targeted projects within the limits of existing policy capacity with HTAs playing a leading role.

Actions	Priority	Time-frame	Roles
6.2.1. **Integrate diaspora engagement across relevant policy areas** through policy documents and programmes (e.g., explicitly referring to the substantial potential of the diaspora to boost innovation and contribute to solving socio-economic challenges in the national development strategy; designing programmes on skills development, validation and recognition for labour migrants).	①	Short-term	The Government of Moldova and the DRB

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Table 6.2 Summary of policy recommendations on leveraging the diaspora for innovation-led development (Continued)

6.2.2. **Enlarge the scope for pilot diaspora engagement initiatives among potential sector or regional hubs** (mainly HTAs and local communities), drawing on the experience and networks of the MiDL and DAR 1+3 projects, in line with and integrated into relevant national and regional economic development strategies.	②	Medium-term	The DRB, partner groups and HTAs
6.2.3. **Expand and build momentum around existing formal and informal academic and professional networks** through new initiatives with donor co-funding, where appropriate, to further strengthen linkages between the diaspora and Moldova (e.g., research groups and individual researchers; business associations and networks abroad; university and alumni networks).	①	Long-term	The DRB, MER and MoE

Recommendation 6.3: Develop and maintain **flexible engagement infrastructure** to interact with the diaspora and foster synergies between diaspora development proposals and Moldova's needs.

It is important to build on existing crowdfunding initiatives for local development with diaspora engagement as well as expand previous Diaspora Excellence Groups and Diaspora Engagement Hub programmes. Enhancing these mechanisms will ensure the sustainable, direct and effective involvement of the diaspora.

Actions	Priority	Time-frame	Roles
6.3.1. **Establish an online diaspora engagement portal that would offer direct connections and communication channels between the diaspora and Moldova-based participants** by matching key diaspora competencies with domestic needs and facilitate forming well-matched teams of researchers and professionals.	①	Short-term	The DRB, UNDP, HTAs, MoE as well as professional and research groups
6.3.2. **Reinforce consular contacts to identify key competencies in the diaspora** and establish new connections with counterparts in Moldova.	②	Medium- to long-term	The DRB and Ministry of Foreign Affairs

Recommendation 6.4: Develop linkages between academia in Moldova and Moldovan researchers, scientists and affiliated organizations based abroad through the **establishment of a Diaspora Science Group.**

As the linkages between networks in Moldova and those abroad are often based on personal connections and rely mostly on ad hoc engagement opportunities, a more focused effort is needed to ensure their sustainability. The Diaspora Science Group could play a leading role in the promotion and fostering of scientific cooperation between Moldovans abroad and scientists, researchers and affiliated groups back home.

Actions	Priority	Time-frame	Roles
6.4.1. **Establish the DSG** under the auspices of the DRB and with support from consulates abroad to streamline scientific collaboration.	①	Short-term	The DRB and consulates abroad
6.4.2. **Introduce mentorship and fellowship programmes** under the guidance of, or run directly by, the DSG. This would involve partnering with and promoting the creation of professional associations of diaspora scientists as well as academic exchange initiatives.	③	Long-term	The DSG, DRB, HTAs, MER and MoE
6.4.3. **Ensure the DSG actively participates in Moldova's high school, university, and vocational education processes** (e.g. guest speakers, course (co)-teachers and contributors to curricula development drawn from the diaspora) to help build local skills and promote knowledge exchanges.	②	Medium-term	The DSG, DRB, MER, UNDP and multilateral donors

Recommendation 6.5: Elaborate policies to maintain **contact and enhance trust** between the diaspora and Moldova while strategically engaging with Moldovans living abroad to benefit the homeland.

Trust is an important prerequisite for engagement in any government-led initiative and often presents a constraint for the Moldovan diaspora. Having trust in the institutions and a connectedness to the homeland is needed to effectively engage any diaspora. Fostering these qualities in the diaspora will require both strategic vision and the concrete means to do so.

Actions	Priority	Time-frame	Roles
6.5.1. **Facilitate a closer association between the diaspora and Moldovan universities** by introducing and maintaining alumni networks.	①	Short-term	The DRB, MER and HEIs

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Table 6.2 Summary of policy recommendations on leveraging the diaspora for innovation-led development (Concluded)

6.5.2. **Minimize the overall administrative and financial burden for the diaspora engaged in development initiatives in Moldova, especially for active professionals and scientists, to encourage greater cooperation** (e.g., ensure the efficient administration of financial support to diaspora members' engaged in Moldova through donor or State-run programmes).	①	Short-term	The DRB, DSG, HTAs and Government of Moldova
6.5.3. **Sustain a meaningful cultural connection** with the diaspora **through dedicated events and initiatives** to promote strong bonds with Moldova (e.g., Diaspora Days, local fares, etc.).	②	Medium-term	The DRB and HTAs
6.5.4. **Enhance and maintain trust** in diaspora policy development through **systematic engagement with diaspora members**, including clear and transparent policy mechanisms and implementation tools.	③	Long-term	The Government of Moldova and DRB in partnership with HTAs and the DSG
6.5.5. **Develop a transparent system of public recognition of achievements and contributions of individual diaspora members** (e.g., awards for the most innovative proposals to develop specific areas of the Moldovan economy, such as communications or education).	③	Long-term	The DRB and Government of Moldova

Source: UNECE.

Notes

1 National Strategy "Diaspora-2025", developed under the Global Joint IOM/UNDP Programme "Mainstreaming of Migration into National Development Strategies" implemented by the DRB under the auspices of the State Chancellery of the Republic of Moldova with the support of the IOM and UNDP. Financed by the Swiss Agency for Development and Cooperation (SDC). Approved: Decision of the Government of the Republic of Moldova no. 200 of 26.02.2016

2 This is also confirmed in the results from Google's n-gram analysis of "diaspora" in the English language literature, peaking in the 2015-2019 period https://t.co/w6xtc7pNuB?amp=1

3 Gevorkyan, A.V. and Gevorkyan, A. 2012. Factoring turbulence out: Diaspora regulatory mechanism and Migration Development Bank. International Migration, 50(1): 96–112.

4 A broad range of such divisions is revealed in the Armenian Diaspora Online Survey, discussed in Gevorkyan (2020). Critically, this suggests a multipolarity of the diaspora category, meaning a uniform policy approach towards engaging the most active members of the dispersed community is not ideal.

5 This assessment is based on the IOM's Migration Profile of the Republic of Moldova and results from the fact-finding mission. For migration profile see https://moldova.iom.int/migration-profile-republic-moldova

6 Vremiş, M. and Vladicescu, N. 2020. Profile and Current Challenges of Moldovan Migrant Workers. Chisinau, Moldova: International Organization for Migration. Available online at https://www.md.undp.org/content/moldova/en/home/library/inclusive_growth/tendin_e-actuale-ale-migraiei-forei-de-munc--evidene-empirice-i-.html

7 For the latest update on labour migration, remittances and migrant profiles in Moldova see https://www.ifad.org/en/web/latest/-/helping-remittances-reach-rural-areas-in-moldova

8 For example, see Nexus (2014) and Cheianu-Andrei (2013).

9 According to Cheianu-Andrei, D. 2013. Moldovan Diaspora Mapping Series II: Mapping of the Moldovan Diaspora in Italy, Portugal, France, and the United Kingdom. Chisinau, Moldova: International Organization for Migration.

10 Same as vi.

11 From the fact-finding mission interviews and migration profile studies cited herein. The most recent migrant profile survey developed by Vremiş and Vladicescu (2020) is highly recommended for a deeper analysis beyond this chapter's focus on the diaspora's role in the development process. The survey offers the definitive characteristics of the labour migration process in Moldova, including addressing the impact of the COVID-19 pandemic on the migrants and some generalizations on possible migrants reintegration.

12 Same as vi.

13 Tejada, G., Varzari, V. and Porcescu, S. 2013. Scientific Diasporas, Transnationalism and Home-Country Development: Evidence from a Study of Skilled Moldova's Abroad. Southeast European and Black Sea Studies. Vol. 13(2): 157–173.

14 For additional information on DAR 1 + 3 see https://moldova.un.org/en/51366-engaging-diaspora-development-their-home-communities-becomes-national-practice-through-dar-13 and https://brd.gov.md/

15 For details on the latest DAR 1+3 competition see https://brd.gov.md/ro/content/start-programul-guvernamental-diaspora-acasa-reuseste-dar-13-editia-2021-prima-sesiune-line

16 Gevorkyan, A.V. 2015. The legends of the Caucasus: Economic transformation of Armenia and Georgia. International Business Review, 24 (6): 1009–1024.

17 Gevorkyan, A.V. 2018. Transition Economies: Transformation, Development, and Society in Eastern Europe and the Former Soviet Union. Oxford: Routledge.

18 As, for example, noted by Piras, S., Vittuari, M., Möllers, J. and Herzfeld, T. 2018. Remittance inflow and smallholder farming practices. The case of Moldova. Land Use Policy, 70: 654-665.

19 As, for example, in Deneulin, S. 2006. Individual Well-being, Migration Remittances and the Common Good. The European Journal of Development Research, 18(1): 45–58.

20 For details see https://tie.org/about/

21 Pande, A. 2014. The role of Indian Diaspora in the development of the Indian IT industry. Diaspora Studies, Vol. 7(2): 121-129.

22 These include the scalability of India's local industry; India's individual diaspora members and networks' spread and penetration across the globally competitive IT sector; the wide range of specialization options across diaspora driven IT clusters in India in contrast to more narrow specialization in some CEE/FSU working in niche sectors; the large-scale return of diaspora members to India and starting their own businesses.

23 The case of the return of Romania's medical sector personnel showcases this clearly.

24 Boncea, I. 2015. Turning Brain Drain into Brain Gain: Evidence from Romania's Medical Sector. Procedia Economics and Finance, Vol. 20: 80-87.

25 As noted in xiii and confirmed in the fact-finding mission gathering background information for this study.

[26] For a wide range of examples beyond the presented select cases, see a recent report on diaspora engagement frameworks ICMPD (2020).

[27] For additional information on Repat Armenia and examples of successful diaspora integration in the new society (including case studies on the Syrian Armenian diaspora) see https://repatarmenia.org. Also see Gevorkyan (2016) for a more in-depth discussion of the diverse entrepreneurial and innovative efforts of the Armenian diaspora.

[28] See https://balinkbayan.gov.ph/about-balinkbayan/

[29] For example, consider the Global Database of Nigerians in Diaspora helping with outreach and streamlining interactions with and within the diaspora at http://www.nigeriandiaspora.org/history.aspx

[30] For additional details see https://www.globalscot.com

[31] As described in Gevorkyan, A.V. 2021. Forthcoming. Diaspora and Economic Development: A Systemic View. The European Journal of Development Research.

[32] For the Austrian Scientists and Scholars in North America see https://ascina.at/ For the Armenian Economic Association see http://aea.am/ To varying degrees, both associations provide some type of research support to their respective diaspora scientists and encourage interactions between the scientific networks in the homelands and those of the international scientific community as well as scientists in the diaspora.

Innovation for Sustainable Development Review of Moldova

The Innovation for Sustainable Development Review contains the findings of a participatory policy advisory service undertaken at the request of the national authorities. It considers possible policy actions aimed at stimulating innovation activity in the country, enhancing its innovation capacity. It also provides policy recommendations on how to harness innovation to achieve national priorities under the United Nations 2030 Sustainable Development Agenda.

UNECE supports closer cooperation among its 56 member States in the pursuit of the UN Sustainable Development Goals (SDGs) and the 2030 Agenda. Its Economic Cooperation and Trade Division (ECTD) assists member States with economic integration and in promoting and enabling a better policy, financial and regulatory environment.

To foster sustainable development, including progressing towards an increasingly circular economy and building resilience to events such as the COVID-19 pandemic, experimentation with ideas and technologies must become systematic across UNECE member States' economies and societies. The Innovative Policies Development Section within ECTD focuses on promoting a supportive environment for innovative development and knowledge-based competitiveness. Activities include policy dialogue, recommendations and good practices, analytical reviews, and capacity-building.

Ms. Elisabeth Tuerk

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